A
COMPANION,
OR
SUPPLEMENT,
TO THE
LADIES' DIARY,

FOR THE YEAR 1790.

Containing CALCULATIONS and TYPES of the ECLIPSES of this Year; and a curious Liſt of all the SOLAR ECLIPSES viſible till the Year 2000. With many additional SOLUTIONS to the ENIGMAS, REBUSES, CHARADES, QUERIES, and QUESTIONS, for which there was not room in the DIARY itſelf; with ſome New REBUSES, CHARADES, QUERIES and MATHEMATICAL QUESTIONS, to be anſwered next year.

By the DIARY AUTHOR.

[PRICE SIX-PENCE.]

SUPPLEMENT
TO THE
LADIES' DIARY,
FOR THE YEAR 1790.

VARIOUS ANSWERS TO THE PRIZE ENIGMA.

13. *Time's Revenge, by Serena, of Newcaſtle upon Tyne.*

PERMIT an old maid to appear in diſguiſe,
A whim having ſeiz'd her to anſwer the prize
Laſt night, being cold, to my bed I did creep;
Reflecting on ſcenes paſt, prevented my ſleep;
When muſing how ſeaſons do alter each caſe,
Old *Time* ſtood before me, and ſtar'd in my face;
He told me he thought I was once a ſmart girl,
And that I had charms might have ſoften'd an earl;
But as I had ſlighted both him and the men,
He ne'er could look on me with pleaſure again:
So, out of revenge, to bring me in diſgrace,
He turn'd my hair gray, and he wrinkled my face;
Then told me, henceforward, the men would all fly me,
And then, what a mortify'd creature ſhould I be.
I laugh'd at his rage, nor will grieve on that ſcore,
For I hope to be happy when *Time* is no more.

But, when in my bloom, if I had known Lee,
(So ſenſible, witty, and ſo degagé,
His genius fertile, he puzzles with art)
I think, if he'd aſk'd me, I'd—yielded my heart.

14. *By Miſs Eliza C——m, of Bath.*

'Tis *Time* from the happy flies ſwiftly away,
And time with the wretched ſeems longeſt to ſtay;
'Tis time, faireſt ladies, that heightens your charms,
and yet it is time which your beauty diſarms,
From the cheek plucks the roſe, and a wrinkle plants there,
And cruelly ſprinkles with ſilver our hair.—
Then let us eſteem him whilſt yet in our prime,
Nor, libertine-like, at laſt wiſh for more Time.

15. *By Mr John Brown, of Wincombe, near Hull.*

Time ſtill on wing is haſt'ning to be gone,
The buſtling moments urge each other on.

So have I ſeen, from a tall mountain's brow,
(The world of waters ſtretching wide below)
Old ocean heave, and with tumultuous roar,
Drive wave on wave impetuous to the ſhore,
But thither ſped, they break, and are no more.

16. *By Miſs Weſt, of Crick.*

Th' ingenious prize enigma to explain,
Long *time* I ſtrove, nor did I ſtrive in vain.
If I am wrong, Diarian nymphs excuſe;
'Tis the firſt effort of a juv'nile muſe.

17. *By Mr Joſ. Cowing, of Newcaſtle upon Tyne.*

Believe me, dear Lee, it will plainly appear,
What you wiſh to conceal, by this *time* the next year;
The editor H—n, by increaſing the arts,
Has won the gay fair, and enliven'd their hearts.
Be the taſk e'er ſo arduous, each ſtrive all they can;
Tho' they gain not the prize, yet admire the man.

18, *The Bellman's Verſe, by Miſs Sally Browne.*

Time brings day, and *Time* brings night;
And *Time* brings all things unto light.
Repent in *Time*, whilſt *Time* you have;
There is no *Time* beyond the grave.
Item, thought I, I've got my proper cue:
So next year this *time*—" Give the girl her due."

19. *By Mrs Rubwell, addreſſed to the Editor.*

With all your fair readers old *Time* will make free:
I find he begins to grow buſy with me:
Which, inſtead of bewailing with tears and with ſighs,
I ſmile that he aids me in finding the prize.

20. *Philo-Diaria's Addreſs to Time.*

Hail, ruthleſs *Time*, whoſe univerſal ſway,
Alike the palace and the cot obey!
To thee my Clio ſtrikes her warbling lyre,
To thee ſhe ſwells her voice, and joins the tuneful quire.
Wide as th' extent of Nature's fair array,
Thou, ever moving, cleav'ſt thy airy way;
One conſtant pace, one rigid motion keeps,
While matter moulders, where thy pinion ſweeps;
While thy fantaſtic hand deſtroys the old,
And caſts new figures in another mould;
While the fair arch, and animated buſt,
Sink at thy feet, and crumble in the duſt;
While Romes and Ninevehs by thine arm deſtroy'd,
Mix with the vulgar ſoil, and leave a ghaſtly void.

21. *By Miſs Louiſa Amelia Harpur, of Briſtol.*

Time, if well us'd, a high reward procures,
Eternal peace and happineſs inſures:
But, if unmark'd by any virtuous aim,
And ſin's black deeds thro' life his progreſs ſtain:
If futile pleaſures conſtantly employ,
Or liſtleſs indolence our hours deſtroy;
He the ſad record on his wings will bear,
No future effort can th' impreſſion clear;
'Tis *Time* the awful evidence ſupplies,
By which we gain or loſe an heavenly prize.

22. *By Mr James Daviſon, of Newcaſtle upon Tine.*

Thy ſolemn numbers, and thy verſe ſublime,
Lee, well are ſuited to their ſubject, *Time*:
Time which, though thunder rend the ſolid rock,
And tempeſts daſh, undaunted braves the ſhock:
Heedleſs as yet, he views the flaſhing fire,
But ſhall one day in raging flames expire:
Great, awful, ſacred day! when *Time* no more
Shall ruin'd cities to their pomp reſtore;
When profligates and atheiſts in deſpair,
Shall pour at laſt the unavailing prayer;
Confounded ſink, o'erwhelm'd on ev'ry ſide;
A Chriſt neglected, and a God deny'd.

23. *By Miſs Alicia S——n.*

Ladies, behold your enemy, old *Time*,
With ſcythe in hand will wither all your prime,
Will dim the ſhining luſtre of your eyes,
And all your numerous beauties make his prize;
The roſy cheek, the ſweet enchanting ſmile,
The ruby lips that every heart beguile;
The ſnowy boſom, and the poliſh'd arm,
Time of theſe beauties can each maid diſarm.
Let us, ye fair, this tyrant's power defy;
By ſtoring well our minds, gain victory;
Laugh at his ravages o'er necks and faces,
And every year improve in mental graces;
More *time* in reading ſpend, and leſs in dreſs,
Sure never-fading beauty to poſſeſs.

24. *A ſerious Soliloquy, by Juvenis Boxonienſis.*

When Heaven, and Earth, and *Time* ſhall be no more,
And nature's ſunk beneath her native naught;
When yon blue region ſadden o'er the eaſt,
Yon verdant landſcape wear a deadlier hue;
When melody forget to raiſe her voice,

Forget to cheer the ſick'ning heart of things;
When from her roots uptorn, the maſſy world,
Return to chaos, and await her doom:
Then ſhall my ſoul, rapt with new vigour, burn,
Scap'd from the fetters of corroding *Time*.

25. *Ode to Time, by Mr Mat. Jackſon.*

Whatever good Heaven does on man beſtow,
Whatever ill, to thee, O *Time!* we owe:
On thee our hopes, on thee our fears depend,
In thee our wiſhes have their riſe and end;
Whoſe ſov'reign power preſides alike o'er all;
By whom the mightieſt empires riſe and fall:
'Tis thine to bring diſeaſe, corroding grief,
And heal affliction's wounds with kind relief;
With adverſe fortune, merit to depreſs,
And ope the door of plenty to diſtreſs.
'Tis thine to forge oppreſſion's galling chain,
And bid the ſlave his liberty regain;
Bid mad ambition urge the aſſaſſin's dart,
And touch with fell remorſe the guilty heart:
Thine to uprear the monumental buſt,
And mix diſtinction with forgotten duſt:
By thee Diaria's tuneful page is ſpread,
By thee Enigma from its veil is freed,
And, *Time*, 'tis thine to give the prize decreed.

26. *The ſame, anſwered by Adelina.*

Diaria's friends may puzzle and perplex,
And veil their thoughts in enigmatic text;
Yet *Time* unfolds, and *Time* will bring to light
Myſterious riddles, now conceal'd from ſight.

27. *Ode to Diaria, by Candidus.*

What vent'rous bard thus dare arreſt the rage
Of one whom no ſubmiſſion can aſſuage?
Who bids my ling'ring hours prolong the day,
And checks my winged ſwiftneſs with his lay?
Say, bold intruder, whence thy powerful aid,
To ſtop what never mortal force delay'd?
Who arms thy hand, who thus directs thy ſkill
To yoke a haughty victor to thy will?
What thus o'ercomes the ſullen ſway of *Time*,
Say, is it Dia's tuneful myſtic rhyme?
Alas! I yield, I own the fated power
Of her, who ſhall ſurvive my lateſt hour.
O'er whom my arrows, that e'en death defy,
Bereft of native bane, unheeded fly.

Long then enjoy thy triumph and thy fame,
What thus makes *Time* ſubſervient to thy name;
While England's fair, enraptur'd, read the line,
Admire thy taſte, and own the ſtrain divine.

28. *On the Death of a Friend, by Mr Tho. Higham, of Lancaſter.*

1. Edwin is gone! the dear-beloved youth!
For ever number'd with the ſilent dead:
Yon bell declares the melancholy truth,
My friend, and, with him, ev'ry joy is fled.
2. Why was his morn with clouds ſo ſoon o'ercaſt?
Blaſted each real and ſerene delight?
Forbear, my ſoul, to think; 'tis done, 'tis paſt,
And he is ſunk in everlaſting night.
3. Yet ſoon, tho' ten-fold darkneſs preſs his eyes,
Yes, tho' the grave triumphant ſeem a while,
Th' Almighty voice ſhall call, ſhall bid him riſe,
And in immortal beauty ever ſhine.
4. All will be well on that reſplendent morn,
When the wak'd dead ſhall meet their awful doome;
Or on angelic wing to glory borne,
Or head-long hurl'd into eternal gloom.
5. Then ſhall my friend, beyond remoteſt ſkies,
With all the ranſom'd throng, ſublimely ſoar;
There with th' eternal quaff immortal joys,
When Heaven, and Earth, and *Time* ſhall be no more.

29. *The Emblems of Time, by Juvenis.*

Of *Time*, the emblem, as of yore 'twas ſaid,
A ſerpent was, his tail inſerted in his head.
Others for *Time* have made an old man ſtand,
Holding a ſcythe and glaſs in either hand.
Some meaning in theſe figures there muſt be:
'Tis true, the circle ſhews eternity;
The ſcythe mows all, the aged and the young;
The glaſs points out the moments as they run.
If you take heed thoſe moments how you ſpend,
You'll gain an happy life, which ne'er ſhall end.

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ALL THE ENIGMAS ANSWERED.

1 Bell
2 Shadow
3 Shuttlecock
4 Letter R
5 Key
6 Umbrella
7 Curtain
8 Ear
9 Noſe
10 Pincuſhion
11 Smile
12 *or Prize*, Time.

13. *An Elegy on the Death of Mr J. Townſhend, by Mr Thomas Woolſton, Maſter of the Boarding School, at Adderbury, Oxfordſhire.*

1. In life's gay morning, ere intruding care,
With torpid hand, benumbs the riſing pow'rs,
The frolic youth deems every proſpect fair,
And fondly hopes to ſtrew his path with flow'rs.

2. Fluſh'd with freſh op'ning joys, his ardent mind,
Unhurt by pain or diſappointment's ſting,
Caſts far the gloomy ſhades of life behind,
And, fearleſs, mounts on Fancy's roving wing.

3. With ſmiles elate, on downy pinions borne,
He courts the ſtrains of pleaſure's ſyren lay,
And takes the orient colours of the morn,
To paint the luſtre of his vernal day.

4. Then holds the picture to his dazzled ſight;
Pleas'd with the tints his laviſh hand has ſpread,
He dreams his days like this ſhall all be bright,
Nor ſees the clouds that hover o'er his head.

5. But ſoon, alas! thoſe pleaſing viſions fly!
For gath'ring dark, the ruffling ſtorms of life
Preſent a different landſcape to his eye,
Shaded by diſappointment, pain and ſtrife.

6. Ah! happy he, who warn'd by Wiſdom's voice,
Prepares betimes to meet thoſe adverſe gales;
The ſober paths of virtue are his choice,
Tho' pleaſure ſtill in Proteus' ſhape aſſails.

7. He, unallur'd by her enchanting wiles,
Beholds her end wrapt up in dreadful gloom;
The ſcenes that paint his face with gayeſt ſmiles,
Extend to realms of bliſs beyond the tomb.
8. Thither his heart aſcends in holy joy;
And hence his mind preſerves a ſacred calm;
For thus he taſtes delights that never cloy,
And draws from thence for every wound a balm.
9. This the pure ſource from whence Alcander drew
His nobleſt joy, a thirſt for wiſdom's lore;
His youthful mind no greater pleaſure knew,
Than her unerring counſels to explore.
10. Devout, at morn and eve he duly ſought
The ſacred records of eternal truth,
And found in rich experience what they taught—
That Virtue's ways are ſafeſt ſtill for youth.
11. 'Twas mine with heart-felt pleaſure to behold
(For friendſhip to my charge the youth conſign'd)
The ſcions ſhoot, the *Early* blooms unfold, 8
And wiſdom's choiceſt fruits enrich his mind.
12. The golden *Key* that opes the gates of light, 5
Alcander's ſoul with holy rapture warm'd,
Plac'd heaven and happineſs before his ſight,
And Death, pale tyrant! of his ſting diſarm'd.
13. Ye giddy youths! who doat on empty toys,
On baubles, light as *Shuttlecock* or air, 3
Like young Alcander, ſeek ſublimer joys,
Let virtue be your guide, and heaven your care.
14. And you, ye *Belles*, whom *pendent Cuſhions* grace, 1, 10
Whoſe charms th' *Umbrella*'s friendly *Shade* defends, 6,2
Reflect how vain the conqueſts of a face,
How ſoon the proud, the boaſted triumph ends.
15. For, like a *Noſegay* pluck'd from vernal ſhades, 9
That droops and withers in the ſolar ray; 4
Beneath affliction, beauty's roſe-bluſh fades,
And all its faſcinating powers decay.
16. But virtue, bright in never-fading bloom,
When *Time* his *Curtain* drops, and nature dies, 12,7
Shall *Smile* eternal triumph o'er the tomb, 11
And with new luſtre gain her native ſkies.

14. *On the Rejoicing for the King's Recovery, by Mr G. Harris, of Thingdon.*

Hark! the merry *Bells* are ringing, 1
For our gracious king's reſtor'd,
Luſtred *Shadows*, folks a ſinging, 2
George our ſovereign king's ador'd:

Shuttlecock nor yet *Umbrella*, 3, 6
Could attract th' admiring crowd,
But each Britiſh loyal fellow
Charm'd the *Ear* with voices loud. 8
Smiles were ſeen on every feature, 11
All expreſs'd a general joy;
Anxious was each loyal creature
His next neighbour to outvie.
Every one drew up the *Curtain*, 7
Illumination to diſplay,
All were loyal, 'tis moſt certain,
By their ſmiles and ſweet *Noſegay*. 9
Letters G. and *R.* were formed 4
On *Pincuſhion*, knots,—what not, 10
And each Britiſh heart was warmed
With illumination-plot.
May the two illuſtrious perſons,
George and Charlotte, long bear ſway;
May their virtues prove a leſſon,
In degenerated *Times*, I pray. 12
So let's praiſe our wiſe protector,
For reſtoring thus our king;
Sing we will, if he's director,
Sweet's the *Key* to every ſtring. 5

15. *To Lady Diaria, by Mr Geo. Stevenſon, School-maſter, at Howdon Dock.*

Dear madam ſo fam'd, you never are nam'd
But I always admire your parts; 4
And now with you joy, which *Time* can't deſtroy, 12
And equal to your vaſt deſerts.

Your mate the mean while, is worthy your *Smile*, 11
Accompliſh'd in learning ſo high;
Your choice all approve, as worthy your love,
And no one more truly than I.

Choice riddles you tell, that ſtill bear the *Bell*, 1
Umbrellas the fair ſex to *Shade*, 6, 2
With a *Pincuſhion* ſmart, in form of a *heart*, 10, 8
And *Toys* for our children are made. 3, 5

Bed-hangings in ſtore, beſides many more, 7
That are moſt ingeniouſly penn'd,
In ſcience you ſtand, the firſt in this land;
While *breath* laſts I am your true friend. 9

16. *On Morning, by Vertigo.*

Night's dark *Umbrella* now is drawn aſide, 6
And the gay morn, with dazzling ſplendors crown'd,
Advances, bluſhing in majeſtic pride,
Diſpenſing light and happineſs around.

Again creation, from a ſhort repoſe,
Awakes renew'd as from a ſecond birth:—
Wet with the dew, how *Smiles* the bluſhing *Roſe*? 11, 4
Low, bending its ſweet head toward the earth!

The lark forſakes her lowly couch to meet
The riſing ſun, and uſher in the day;
Artleſs her ſtrain, irregular, yet ſweet,
Till fading on the *Ear* her notes decay. 8

Jocund the plowman to the field repairs,
To turn the glebe, and fertilize the ſoil;
A ſtranger he to wealth, and all its cares—
Sweet ſleep at eve repays him for his toil.

What tho' he cannot boaſt of high deſcent,
Or claim a kindred with the rich and great;
Yet ſmiling peace is his, and ſweet content;
For happineſs with him has fix'd her ſeat.

The dazzling *Belles* may captivate the ſight, 1
Sparkling with pearls and gems, a borrow'd glare,
The dew-beſprinkled lawn appears more bright
Than all the coſtly ſplendours which they wear.

A thouſand fragrant ſmells ſalute the *Noſe*, 9
Blown from the flowers that bloom amid the fields:
Now let ſloth leave her *Cuſhion* of repoſe, 10
And taſte the ſweets refreſhen'd nature yields;

Before the ſun emits his fervid ray,
And the gay flowers of morn fade on the eye;
For ſoon they'll haſten to a ſwift decay;
Tranſient their luſtre—they but bloom and die.

So beauty fades, ſo ſickens on the ſight,
(Soon the gay ſeaſon of delight is o'er)
Time veils the faireſt feature in dark night, 12, 7
Lock'd in the grave, beauty can pleaſe no more. 5

For life at laſt is but a fleeting *Shade*, 2
That like the winged *Shuttle* ſwiftly flies; 3
But yet the ſoul immortal ſhall not fade,
But bloom for ever in its kindred ſkies.

17. *Addreſs to the* SHUTTLLECOCK, *by Mrs Margaret Fitzgerald, of Old Moſs, Cheſhire.*

Ah! once thou pleaſing, yet thou childiſh *toy*, 3
For me thou'ſt danc'd, for me thou'ſt wing'd on high:
But now no more! no more thou'ſt power to pleaſe,
Thoſe charms are fled! fled with my youthful days;
No joy can now attend a frozen maid,
Whoſe youth is gone, whoſe pleaſing *Smiles* are fled. 11
The beau with broad *Umbrella* ſtruts along, 6
Nor *hears* nor ſees me, but joins the giddy throng; 8

With turn'd-up *Noſe* I'm now oblig'd to ſit, 9
The jeſt and laughter of each ſneering wit;
Neglected thus, and ſcorn'd by ev'ry eye,
Neglected! yes, in ſecret forc'd to ſigh: 4
Remorſeleſs wretches, not one tender glance,
One ſoft expreſſion, nor one kind advance:
No matter, I'll lament and ſigh no more,
But cloſe my *Curtains, lock* and bar my door; 7, 5
Soon the world's forgotten, and unknown,
Nor ſhall the world much longer ſee me moan;
Then will my *Time* in ſilence glide away, 12
Like the dim *Shadow* of a ſummer's day; 2
A *Pin* for all the buſy ſons of ſtrife, 10
Can think or ſay of my retired life;
And when I'm dead (farewell ye haughty crew)
The *Bells* ſhall ring; farewell; adieu! adieu! adieu! 1

18. *The different Stages of Life, by Mr Wm. Jones, of Heyford.*

1. That life's but a *Shadow* at beſt, 2
And *Time* like a *Shuttle* doth fly; 12, 3
The wiſe of all ages confeſt,
And who can theſe maxims deny?

2. In youth the gay proſpects expand,
And pleaſures attractive invite;
We mix with the frolickſome band,
The *organs of ſenſe* to delight. 8, 9

3. 'Tis then our fond wiſhes declare,
The raptures of Hymen we'd prove;
We *trinkets* preſent to the fair, 1, 5, 6, 10
And ſigh our allegiance to love.

4. But when we to manhood advance,
A throng of rude cares intervene;
The moments of joy to enhance,
And checker the quick-changing *Scene*. 7

5. The dear-bought experience of youth,
Now places each error in view;
We eagerly ſearch after truth,
And precepts of wiſdom purſue.

6. But manhood with haſte will decline,
And age all-impotent appear; 4
Deep furrows his forehead entwine,
Diſeaſes crowd thick in his rear.

7. If then we true pleaſure would taſte,
From vice's fell ſnares let us flee;
That when we reflect on the paſt,
The proſpect delightful may be.

8. To thoſe who on virtue rely,
Death's but a ceſſation from pain ;
His terrors, his darts they defy,
And meet all his frowns with a *Smile*. 11

19. *The Enigmas, Rebuſes, and Charades anſwered, by Mr Joſeph Nendick, of Old Malton.*

Can'ſt thou, my muſe, deſcribe the wonders ſeven ;
Unhinge the gates, and turn the *Key* of heaven ? 5
Or draw the *Curtain* from each mortal eye, 7
And ſing of Him that reigns above the ſky ;
'Twas he that fram'd the concave ſtarry zone,
'Tis he that rules the grand imperial throne ;
At his command the birds in chorus ſing,
And hail return of ſoft and *Smil*ing ſpring ; 11
Thro' him the dove's puff'd up with pride elate,
And keeps her *contract* with her *ſpot*leſs *mate* ;
Hark ! how the twain pour forth their cooing ſtrains,
While *ſcenting* odours *ſport* along the plains. 9, 2
Lo, from yon *Crab-tree*, ſee the Linnets fly ;
See how the *Cowſlips* ſpring, bloom, fade and die ;
Juſt ſo we're gone——then ceaſe, my raptur'd muſe,
Yon ſolemn *Bell* proclaims the doleful *news*. 1
Thus doom'd to ſleep in *ear*th's cold dreary womb, 8
A verdant *Canopy* o'er*ſhades* each tomb. 6, 2
Farewell to *Smales*, to *Young*, and *Jonſon* too,
And *Freeman* eke—to lower worlds adieu.
How ſoon, alas ! frail life's gay ſeaſon's o'er,
How ſoon we're gone, and riſe to fame no more,
Till *Time* and ſpace are from their order hurl'd ; 12
And ſweeping flames ſpread o'er a trembling world ;
Then ſhall our duſt on golden *pin*ions riſe, 10
To *R*egions far beyond the vaulted ſkies. 4

20. *The Invitation, a Paſtoral, by Mr John Jackſon, of Hutton-Rudley School.*

Come, Chloe, be pleas'd with a *Smile*, 11
Let *Keys* now no longer be mute, 5
Our lambkins let's tend for a while,
I'll play you a tune on my flute.

Or if you had rather, a game,
The *Shuttlecock* ſhall us amuſe ; 3
I have one ; to me 'tis the ſame ;
To pleaſe you I ne'er can *R*efuſe. 4

When tir'd we'll ſit down to reſt,
By the ſtream on the moſſy bank-ſide,
Where blue-*bells* and daiſies are dreſt, 1
The *Umbrella* ſhall both of us hide. 6

Like *Curtains* to *Shade* us from heat, 7,2
Or vapours diſtilled to ſhowers;
We'll ſafely, in this ſmall retreat,
Prick the *Cuſhion*, or cull the gay flowers. 10

Our *Noſes* perfume with the ſcent, 9
While birds they do raviſh our *Ears*; 8
Then, Chloe, but give your conſent,
My *Time* I'd employ thus for years. 12

21. *On Autumn, anſwering the Enigmas, &c. by Mr John Elliott, of Malton.*

Ariſe, my muſe! in ſacred friendſhip riſe,
And raiſe my theme above the lofty ſkies;
Come ſound this *Seaſon*'s praiſe, my raptur'd ſoul,
And let thy notes be *hear*d from pole to pole; 8
While Jonſon's pen, or Freeman's *Bells* declare 1
What bleſſings now attend each Britiſh fair.
Farewell the pride of Flora's vivid ſcene;
Adieu to ſummer's eye-delighting green:
Sol's beams, like *Shuttlecocks*, now from us fly, 3
The flowers now fade, their beauty ſoon muſt die;
The *Cuſhion*'d banks now haſten to decay, 10
Turn brown and fade, juſt like the new-made hay;
Now Libra weighs the harveſt's golden ſtore,
And Ceres worſhip'd is by Swains once more:
On every ſide beneath the *ſmil*ing ſky, 11
Both old and young their crooked ſickles ply;
Beneath a Crabtree, or an aged thorn,
(The peaſant's *canopy* in fields of corn) 6
See *R*eapers ſeated on the *ſhady* graſs, 4, 2
With rural News their ſtinted *minutes* paſs; 12
The ſportſmen draw their *Curtains*, and prepare 7
Themſelves for tea, then to the fields repair,
The pointer's *Noſe* directing to the game, 9
They draw the ſpring, and take their cruel aim.
O ceaſe, tyrannic tribes, ye ſons of earth,
No longer deal in ſlaves, nor cruel mirth,
But let your hearts to pity be inclin'd,
That you the *Key* of heaven's gate may find. 5

22. *Epigrammatical Anſwer, by Mr Thomas Waring, Leiceſter.*

When Nox her *Shading Curtain* ſpread, 2,7
And Phœbus needs muſt hide his head,
The midnight revels then prevail,
Plays, concerts, balls and madrigal.
Dick Tweedle's wife, a ſinging fair,
Thought concert was moſt debonair,

And in a hurry haſtes to dreſs,
That ſhe her plaudits may expreſs
The *Key* the drawers ſoon unbind, 5
And homely form is ſoon refin'd; 4
Cork-heel'd ſhoes, and bouncing *feather*, 3
And *Umbrella* to ſcreen from weather; 6
No *Smil*ing *Bell*e with *Noſe*gay neat, 11, 1, 9
Or *Cuſhion*'d hair was more complete. 10
Then Dick with ſpouſy arm in arm,
To hear the modern Mara charm.
But ſpouſy's high ambition roſe,
And to her partner did diſcloſe
Her ſen*time*nts; my dear, ſays ſhe, 12
Now ſay—does Mara equal me?—
Her pipe is charming to be ſure,
But yet, I think mine ſomewhat more.—
Dick, chagrin'd at his wife's ambition,
Hinted Midas's known condition;
Says he, be cautious—I've my fears,
The gods may graft you aſſes *Ears*. 8
Graft aſſes ears——make me a brute——
Ye gods! propitious grant my ſuit,
As a reward for impious ſcorns
Not only *ears*, but graft him *horns*.

23. *Ode to May, by Mr Geo. Cowen, of London.*

Welcome, ſweet May, thy *ſmil*ing beams 11
Bedecks the ſylvan ſcene,
Now Flora's train in grandeur gleams
Upon the verdant green.

Sweet *Noſe*gays now each breaſt adorn, 9
Cull'd from the *open* field; 5
And *Time* has urg'd the blooming thorn 12
Its ſweet perfume to yield.

The ruſtic ſwains beneath the *Shade* 2
At *Shuttlecock* now play, 3
And Colin, with his lovely maid,
Surveys the growing hay. 4

Then to the lonely vale they hie,
Where muſic ſtrikes their *Ears*; 8
The ringing *Bells* ſweet harmony 1
Their ſouls with tranſport chears.

The ſpreading bough an *Umbrell'* is, 6
Or *Curtains* for the *bed*, 7, 10
When Colin takes th' extatic kiſs,
And Phebe wooes to wed.

24. *Ode to Winter, by Mr John Burrow, of Boltonfield.*

1. Stern winter now, in ſhiv'ring cold,
His gloomy reign begins to hold,
And uſhers in the year;
The *Curtains* cloſe at night are drawn, 7
Umbrella too by day is borne, 6
To ſhield the *Noſe* and *Ear*. 9, 8

2. At *Pincuſhion* or *Shuttlecock*, 10, 3
Or on the ice the cold to mock,
The boys their time employ;
Regardleſs of the death-*bell* ſound, 1
That ſtrikes the air with awe profound,
And often damps our joy.

3. If future works demand our care,
Theſe future works, O God! prepare
Productive of thy praiſe;
Let ſpotleſs virtue ever ſhine,
And ſhed a luſt*r*e all divine, 4
In theſe degenerate days.

4. Extend thy favour far and near,
Let tongue and pen thy name revere,
And keep thy righteous laws;
That when in *Shades* our bodies lie, 2
Our ſouls ſhall mount above the ſky,
And praiſe the firſt great cauſe.

5. O may Britannia's favour'd iſle
Embrace Jehovah's ſacred *Smile*, 11
And join from ſhore to ſhore;
Let true religion's kindling ray
In ev'ry ſoul its charms *diſplay*, 5
Till *Time* ſhall be no more. 12

25. *By Mr J. Singleton, of Aſhton Free-ſchool, near Wigan.*

Some will form romantic ſtories
On the ſp*r*ing or autumn glories; 4
Or in fine majeſtic ſtrains
Paint ſtern winter on the plains:
But I, unſkill'd in gingling rhyme,
Shall make no theme of any *Time*; 12
But plainly *ope*' my humble thought, 5
Without deceit, for ſo I ought:
I'll *Bell* and *Shadow* make appear: 1, 2
Of *Shuttlecock*, *Umbrella*, *Ear*, 3, 6, 8
I'll draw the *Curtain*, and diſplay 7
Plain as your *Noſe* a *Cuſhion* gay. 9, 10
Then, ladies, one ſweet charming *Smile* 11
Will recompenſe for all my toil.

Room will not permit farther than juſt to mention, that ingenious general anſwers were alſo given by the following ladies and gentlemen; viz. Adalina, Adoleſcens, Aramont, Rob. Barwick, Wm. Boyer, L. Bowden, Wm. Judſon Bowthorpe, Geo. Brown, Sally Browne, Wm. P. Burman, Nancy Burnell, Eliza C—m, John Cairnes, John Craggs, Thomas Crosbey, Tho. Davis, Rd. Dening, Tho. Elmer, W. Exull, Nancy F—tt, Cumberland Farmer, T. George, John Greene, W. Gradidge, Wm. Hart, John Hawkes, Rob. Hendy, Tho. Higham, Nich. King, Tho King, J. H. Knight, John Liddel, G. Lodge, Cha. Metcalfe, Tho. Metcalfe, J. Needham, S. Oliver, Wm. Paul, Philodiaria, Da. Roberts, Alex. Rowe J. Sampſon, Shepherd of Arno's Vale, Joe Sherwin, Billy Shortſhanks, Fra. Smith, Rob. Smith, Emma Spencer, Mary Spencer, Strephon, Wm. Swift, J. Thankfull, R. Thompſon, J. Tweddle, I. W. of Farndale, W. Weatherill, Geo. Wilcockſon, Wildcotienſis, &c.

ANSWERS *to the* REBUSES *and* CHARADES.

Rebuſes.	*Charades.*
1 Smales	1 Bargain
2 Freeman	2 Tea-pot
3 Jonſon	3 Cowſlip
4 Mary Swift	4 Seaſon
5 News	5 Woman
	6 Farewell
	7 Crabtree
	8 Spring-tide

9. *The Rebuſes anſwered by Mr G. Lodge of Linton.*

Miſs *Smales*, the lovely Diarian, is found,
Whoſe beauty and taſte are juſtly renown'd;
Miſs *Freeman*, Miſs *Jonſon*, are witty and fair;
With Miſs *Mary Swift* but few can compare:
A plentiful choice of partners for life;
Good *news* for young bachelors ſeeking a wife.

10. *The Charades, by the ſame.*

In the *ſeaſon* of ſpring when *Cowſlips* abound,
And Flora's gay beauties enamel the ground;
By the *Crab-tree* in Weſton, midſt of the green,
Where young men and *Women* aſſembled are ſeen;
To purchaſe ſome *Bargain*, quite cheap from the fair,
Tea-pots, cups and ſaucers of true China ware;
Ribbands and gauze, fans, lawn, and fine lace,
With articles plenty, each fair one to grace;
To the ſign of *Spring-tide* they joyful advance,
There each lad leads his laſs, to join the briſk dance.
Thus the evening they ſpend: what joy can excel?
Nor till morning appears, they take their *farewell.*

11. *The Rebuſes anſwered by Mr Wm. Weatherill, of York.*

In *Freeman*'s form tho' grace and beauty ſhine,
Or *Jonſon* for good-nature be renown'd;
Tho' *Mary Swift* be juſt like one divine,
With fame's beſt laurels *Smales* ought to be crown'd.
All muſt admire when ſhe re*news* her ſtrain,
To form the myſt'ries in Diaria's train.

12. *The Charades, by the ſame.*

In *Springtide*, the *Seaſon* when *Cowſlips* are ſeen,
And nature receives her new garment of green;
While in bloſſoming *Crab-trees* the linnet's ſhrill ſtrains,
Rais'd to ſweeteſt of muſic, reſounds thro' the plains:
When *Females* from *Tea-pots* in parties repair,
To cull the ſweet violets, and breathe the freſh air:
While Hodge, with his *Bargain*, bids *Farewell* to town,
Content as a prince in the ſtate of a clown.
What pleaſures then court us to taſte the delight
That *Flora*'s gay offſpring preſents to our ſight!

13. *The Charades by Mr J. Hunt, Maſter of the Boarding-School, at Stony Stratford.*

How delightful the *Seaſon* appears,
When gay *Cowſlips* enamel the ground;
For the aſpect that nature then wears,
Is enchantingly beauteous around.
But how ſuddenly chang'd is the ſcene,
When my *Charmer*'s compell'd to depart;
Then the meads are depriv'd of their green,
And *Farewell* rends my terrify'd heart.
Not e'en *gold* can my ſenſes allure,
Nor dear *Noon-tide*'s* enlivening rays;
For the griefs I from hence muſt endure,
Are the canker, the ruſt of my days!
If I meet with Letitia at *Tea*,
She but *Crabbed* appears to my view;
For 'tis Polly alone pleaſes me,
And I ſigh for no face that is new.

14. *The ſame, by Mr Wm. Gradidge, of Canterbury.*

In *Spring*, when ſtern winter had bade us *Farewell*,
Down the meadows I rambled with Kate of the vale;
Some *Cowſlips* to gather, a garland to make,
In order the laſſes to meet at the wake:
The *Seaſon* ſo pleaſant, a *Bargain* I made,
To trip it with Kitty upon the ſmooth glade,

---

* Or *Spring-tide.*

Where under the ſhade of ſome evergreen *Tree*,
The *Women* had made us a nice diſh of *Tea* ;
The time paſs'd ſo ſwiftly and pleaſant away,
That we hardly could part at the cloſe of the day.

15. *Addreſs to Mr Eland, by Mr S. Oxley, of Wolſingham.*

No more rehearſe your moving tales,
Of your once favour'd Betty Smales,
  Since now from you ſhe's fled ;
The *Bargain*'s made, the knot is tied,
For Richardſon's made her a bride,
  And ta'en her to his bed.
At Wolſingham ſhe now does dwell,
" Within her moſs-grown rural cell :"
  I'd wiſh to ſee you there ;
With you to *drink* a friendly *pot*,
And make you *wel*come to my cot,
  With my beſt homely *fare*.

16. *The Rebuſes and Charades anſwered by Wildicotienſis.*

Fare*well* winter's froſts ; I ſing
Welcome to returning ſpring ;
Prime of *Seaſons*, joyous we
With true rapture welcome thee.
Now the *Cowſlips* ſweet appear,
Nature ſmiles upon the year ;
Now in gaudy beauty dreſt
The *Crab-tree* rears his flow'ry creſt ;
Now we ramble where we chooſe,
Gathering health as well as *News* ;
Stop at ſome old *Woman*'s cot,
And taſte the ſweets of her *Tea-pot* ;
For buns we *Bargain*, and plumb-cake ;
Then home again our jaunt we take.
There Mary Prior oft regales,
With Freeman, Jonſon, and Miſs Smales.

17. *The Invitation, by Mr Iſaac Gumley, of Anſty.*

Come Laura, thou *woman* moſt dear to my heart,
  The *ſeaſon* invites us to rove ;
The *Cowſlips* their delicate odours impart,
  And *Spring-tide* appears in the grove.
The blackbird and linnet, how ſweetly they ſing !
  The *Crab-trees* how gaily they're dreſt !
Each ſwain is content, and more joy'd than a king,
  Each nymph of her wiſh is poſſeſt.

Then bid a *Farewell* to the noiſe of the town,
The peace of the country to ſhare;
Say,—ſay 'tis a *Bargain*,—your *Tea-pot* ſet down,
And come, O my delicate fair!

18. *Addreſs to the Diary, anſwering the Rebuſes, by Strephon.*

Excuſe, dear Di, while I in humble guiſe,
With pleaſing *News* your num'rous friends ſurprize;
Let Mary Swift, and Jonſon, known to fame,
And Freeman liſt, whilſt I the fact proclaim:
That Richardſon, whom every ſong approv'd,
He whom we envied, yet in envy lov'd;
He, fav'rite youth, of all your ſons the pride,
Laſt Lammas made the lovely *Smales* his bride.
So may their time in ſweeteſt circles move,
Still be they happy, as now bleſt in love.

19. *The Wedding, by Mr John Jackſon, of Hutton-Rudby.*

Liſt, *Jonſon* and *Freeman*, *Mary Swift*, to my tales;
Great *News* I have here got to tell;
The far-famed Richardſon's wed to Miſs *Smales*,
The girl who has long borne the bell.

Ere the *Bargain* completed, you found how laſt year
Young Eland declined his ſuit,
Saw the grapes like the fruit of a *Crab-tree* appear,
'Twas *Woman, Farewell* without doubt.

The caſe now thus chang'd, may the *Spring-tide* of love
Ever *Seaſon* the nuptial bands;
And a verſe on the *Cowſlip* or *Tea-pot* ſtill prove,
They both bleſs the day they join'd hands.

20. *The Charades, by Mr. Tho. Eland.*

To *Bargain* and *Tea-pot*, add *Cowſlip* and *Seaſon*,
And next a ſweet *Woman* who hearkens to reaſon;
Farewell, ſurly *Crab-tree*, the *Spring-tide* of life
Flows ſweetly along with ſo charming a wife.

21. *The Charades, by Mrs Mary Clifton, of Old Malton.*

The *Spring*'s replete, the balmy zephyrs play,
And radiant Phœbus glares a noon-*tide* ray;
The ſoaring lark o'er *Cowſlip* meadows fly,
All hail *Farewell*, then climb the vaulted ſky.
Haſte, haſte, fair maids, the *Seaſon*'s rolling on,
Your *Bargains* make ere *Crab-tree*'s bloſſom's gone;
While round the *Tea-pot* chant your rural lays,
And ſing frail *Woman*'s well-deſerved praiſe.

22. *The Reſcue, by Mr John Fildes, Schoolmaſter, Liverpool,*

At noon one day a ſwain on Merſey's ſhore,
Beneath the *Crab-tree* did his fate deplore;
A *Spring-tide* urg'd the waves more high to flow,
Againſt the banks where yellow *Cowſlips* grow.
Alas! he cry'd, what now to me avails
The fame of *Freeman*, *Jonſon*, *Swift*, or *Smales*;
Since ſhe who only can my ſoul delight,
Rejects my love, and now avoids my ſight.
The lovely *Woman* is by moſt confeſs'd
To be the faireſt, and to be the beſt
Of all her ſex; and oh! when I review
The happy hours that once with her I knew;
Each pleaſing circumſtance *renews* my grief,
Nor can I ever hope to find relief.
Each *Seaſon* now by me unheeded flies,
And frail as *Tea-pots* ſeem all earthly joys:
Farewell each hope, death ſoon ſhall ſooth my care,
And end at once my life and my deſpair.
So ſpake the ſwain, but onward as he hied
To throw himſelf into the raging tide,
The maid, who heard his plaint, now nearer drew,
And, touch'd with pity, to his aid ſhe flew:
With rapture he the trembling nymph ſurvey'd;
She own'd her love, and they a *Bargain* made,
That Hymen early the next day ſhould join
Their hands, and make their happineſs divine.

Many other ingenious Anſwers to the Rebuſes and Charades, were given by the following Ladies and Gentlemen; viz. Adalina, Adoleſcens, Agricola, Aramont, Rob. Barwick, W. Boyer, J. Bradley, Geo. Brown, Wm. P. Burman, John Burrow, Eliza C—m, John Cairns, Candidus, John Cavill, John Craggs, J. Elliott, Tho. Elmer, John Griffith, G. Harris, Rob. Hendy, Wm. Jones, Nich. King, Tho. King, John Liddell, S——a M——e, Tho. Moulſon, John Needham, Sam. Oliver, John Pytches, G. R, Da. Robarts, Alex. Rowe, John Sampſon, Billy Shortſhanks, John Singleton, Wm. Swift, Ralph Tweddale, Tho. Waring, Geo. Wilcockſon, and J. J. Willins.

ANSWERS TO THE QUERIES.

Query 1. *Anſwered by Mr Geo. Stevenſon, of Howdon Dock.*

Perſons of oppoſite ſexes cannot hold a ſtrict friendſhip, without ſome degree of love. On which ſubject the Spectator, in one of his numbers has diſcourſed fully, where he makes it appear, that the perſons themſelves often do not perceive they are in love for ſome time, and gives ſome uſeful advice to the fair ſex, warning them in the motto, to "beware of the ſnake in the graſs," that is, to be cautious how they enter into ſuch friendſhips, leſt deſigning men ſhould improve favourable opportunities to their ruin, &c.

It is therefore imprudent in either ſex to commence ſo ſtrict an intimacy, without circumſtances will permit an union; as love, when arrived to an high degree, is often fatal to the peace of mind, and conſequently health of body, when diſappointed. They ought therefore, by abſence, or other means, to ſuppreſs the paſſions, and more eſpecially when one of the parties is married. And as love, in Smith's Philoſophical Dictionary, is proved to be only a diſtant deſire of enjoyment, being its ultimate end; it is further apparent, that the parties ought to diſcontinue their acquaintance, as in an unguarded hour it may lead them to criminal connections.

The ſame, by Mr John Dalton, of Kendal.

There are numerous inſtances undoubtedly to be met with, where two perſons of oppoſite ſexes maintain a ſtrict and honourable friendſhip, without any degree of love. When the ardour of youth is moderated by time, and when reaſon and religion have reduced the paſſions into due ſubordination, there ſeems no reaſon, why a ſimilarity in diſpoſition and ſentiment may not effect a friendſhip between perſons of different ſexes, when perhaps, from their ſituation in life, an indulgence of natural affection would be inconſiſtent with virtue, and conſequently alike diſclaimed by both.

However, if the parties are young, and unmarried, and there be no great diſparity in age, it may then, I think, be deemed a moral impoſſibility for ſuch a friendſhip to exiſt between them, without ſome degree of love. And ſhould one of the parties marry in ſuch a circumſtance, it would rarely tend to their mutual happineſs to continue ſuch an intimacy, eſpecially if love was the baſis of it.

The ſame, by Mr J. Elliott, of Malton.

The natural and neceſſary inclinations which the oppoſite ſexes have for each other, is a convincing proof, that it is impoſſible for two perſons of oppoſite ſexes to hold a ſtrict friendſhip with each other, without ſome degree of love. And as reaſon governs the natural paſſion no otherways than as a judge or admonitor, as far as reaſon and the paſſion co-operate to one end, the will is determined to act; but we find the natural paſſion ſo often deſpotic, that it biaſſes the will to act againſt reaſon. From which I infer, that ſuch a friendſhip ought not to be cheriſhed, any further than by a diſtant civility, after the marriage of one of the parties is conſummated.

And in a ſimilar manner this query is anſwered by moſt of our correſpondents; though the reſt are of a different opinion.

Query 2. *Anſwered by Mr J. Walton, of Allen Town.*

After ſhewing, by a geometrical ſcheme, the direction and effect of refracted and reflected rays in the watery particles of the atmoſphere, ſimilar to thoſe in the rainbow, Mr. Walton infers that, "it will be an eaſy matter to account for the different appearances in the evening and morning: for if it is red in the evening, that vapour which is floating in the air near the ſurface of the earth, has time to diſperſe in the night, as the exhalation is conſiderably leſs after the ſun ſets, than in the day time. But if it is red in the morning, the clouds that are condenſed near the earth, are augmented by the exhalations of the ſun, and ſo for the moſt part fall down in rain that day. Whereas, on the contrary, if they are higher in the atmoſphere, they are diſperſing: whence the common adage, "An evening red, and a morning grey, are always ſigns of a fine day."

The ſame, by Mr J. Jackſon of Hutton-Rudby School.

When the ſky is red and lowring in the morning, if the ſun's rays fall upon the top of the vapours in the ſame manner as they do upon the top of the interior rainbow, they will be the leaſt refracted, and conſequently red: from which the vapours muſt in courſe be very low and groſs, and therefore in this, as in ſimilar cauſes, the effect will be foul weather. But in the evening, if the vapours, by the ſun's heat during the day, have been exhaled to ſuch a height, and are of ſuch a denſity, as for the ſun to refract the lower part of them only, as it does the lower part of the exterior rainbow, the effect, on account of their being the leaſt refracted, will again be red; and as the vapours are at ſo great a height, fair weather may be expected.

Mr Henry Mellanby, of Stockton, ſays,

"When it is evening, ye ſay, it will be fair weather, for the ſky is red; and in the morning, it will be foul weather to-day, for the ſky is red and lowring." A particular emphaſis ought to be laid upon the word *lowring*; for the ſky may be red in the morning, and the day prove fair; which, when it ſo happens, either at morning or evening, the clouds are then at ſuch a height as to refract the red rays only.

Query 3. *Anſwered by Mr Thomas Metcalf, of Reeth, near Richmond, Yorkſhire.*

It is to be obſerved, that the egg is always quite full when it is firſt laid by the hen, but from that time it gradually becomes leſs and leſs ſo, to its decay; and however compact and cloſe its ſhell may appear, it is nevertheleſs perforated with a multitude of ſmall holes, though too minute for the diſcernment of our eyes, the effect of which is a daily decreaſe of matter within the egg, from the time of its being laid;

and the perſpiration is much quicker in hot weather than in cold.

To preſerve the egg freſh, there needs no more than to preſerve it full, and ſtop its tranſpiration; the method of doing which is, by ſtopping thoſe pores with matter which is not ſoluble in watery fluids; and on this principle it is that all kinds of varniſh, prepared with ſpirits of wine, will preſerve eggs freſh for a long time, if they be carefully ſpread all over the ſhell. Tallow, or mutton fat, is alſo good for this purpoſe, and will in like manner preſerve the eggs freſh for a long time.

The ſame, by Mr Tho. Leybourn, of North Shields.

The reaſon I think is plain, viz. by ſtopping the communication with the external air; and therefore it is, that many other methods of doing the ſame thing, alſo ſucceeds in a proportionate degree; ſuch as keeping the eggs in flour or bran, &c. I have alſo made the experiment another way, which is thus; I put an egg into a ſmall hole in a rock, and ſtopped the hole cloſe up with lime; and I alſo put another egg into a hole of the ſame rock, and left here a ſmall vacancy, or opening, for a communication with the outward air. This was done on the 24th of November, 1788; and on the 7th of April, 1789, I took the two eggs out of tlle rock, when I found, by breaking them, that the former was quite freſh and good, but the latter quite corrupted, and gave one of the moſt offenſive ſmells I ever felt in my life.

The ſame anſwered by Vertigo.

It is found, by experiments on the air-pump, that air is one of the principal cauſes of putrefaction; as the fleſh of animals, &c. may be preſerved for a conſiderable time untainted, beneath an exhauſted receiver. Hence it follows, that when the ſhell of an egg is varniſhed, as it is then impervious to the air, or the communication with the air cut off, the fermentation ceaſes, or is prevented.

Query 4. *Anſwered by a Goſportonian.*

It is well known, that all objects appear larger through a miſt or fog, the drops of which are like ſo many magnifying glaſſes to the eye. And the reaſon why the ſun appears ſo much larger in the morning, than in the evening, is to be attributed to the morning miſt, which is exhaled from the earth, during the abſence of the ſun; whereas, in the evening, we ſeldom have any miſt till the ſun is ſet.

The ſame, anſwered by Mr Joſ Cowing, of Newcaſtle.

When the ſun is near the horizon, it is evident that the rays muſt paſs through a greater quantity of the atmoſphere before they reach the eye, than in a more elevated ſituation; and it has been obſerved, that the denſer the medium, the leſs luminous the ſun appears; and conſequently, the larger he will ſeem to be. Hence he muſt appear larger in the morning, when the atmoſphere is denſer with vapours, than in the evening, when it is clearer.

The ſame, by Mr John Needham, of Hinckley.

The air in the morning is much denſer than in the evening, in our hemiſphere, which is cauſed by the abſence of the ſun's rays in the night, when it is charged with dew and vapours. And it is clearly proved by Mr Ferguſon, in his Aſtronomy, page 98, that an object viewed through a foggy or miſty air, will appear larger than when the air is pure and thin. Conſequently, the difference in the ſtate of the atmoſphere, between the evening and morning, is the cauſe of the ſun's appearing larger in the latter than in the former, though both are viewed with the ſame angle.

Query 5. *Anſwered by Mr John Jackſon, of Hutton-Rudby.*

When a perſon happens to ſee or hear another yawn, I do not know any better reaſon can be aſſigned for it, than that given in the Ladies Diary for 1769, from Clare's Treatiſe on Fluids. But I believe, a perſon may be urged to yawn, from another perſon's yawning in the room, though he neither ſees nor hears the perſon yawn. I have often yawned ſilently, when ſtanding behind another perſon, who commonly yawned near at the ſame time, though he neither ſaw nor heard me yawn; for which reaſon, I think the principal cauſe is as follows: The undulatory motion in the air, cauſed by people breathing, &c. in a room, is forcibly impelled by a long wave to and from the perſon that yawns; and another perſon ſitting within the ſphere of motion of that wave, has his common courſe of reſpiration interrupted, and he joins in the ſame continued breath with the perſon yawning.

The ſame, by Mr Tho. Croſbey, of Peaſehaulm, York.

This query is thus anſwered in Clare's Fluids. We find that every part of the animal ſyſtem is made up of fibres, of which the muſcles, tendons, and nerves are compoſed, in various degrees of tenſions, according to their texture, office, and uſe; all which are ready to receive impreſſions, from the moving of their uniſon ſtrings, and join in concert with them. Now when a company, by long watching, or ſome great application, have their nerves, and ſyſtem of fibres all relaxed, and want bracing up, nature then lends her helping hand to the perſon who more immediately wants it, by ſetting him a yawning and ſtretching; the reſt, who are in the ſame plight, ſtrike the uniſon note, and carry the concert round from one to another, till the whole company catches the contagion, to which the eye-ſight doth not a little contribute.

The ſame, by Mr John Dalton, of Kendal.

I take the act of yawning, with numerous other involuntary acts of the like nature, to proceed from that diſtinguiſhing feature of humanity, ſympathy. The mind feels a natural impulſe to participate of whatever affection another appears poſſeſſed off: joy cannot be obſerved in others without a ſmile, nor grief and melancholy without dejection, by an indifferent ſpectator, though he know nothing of their cauſes: to ſee a perſon in danger of falling from a precipice, or upon ice, &c. one is impelled to act in a manner to ſave oneſelf, as if in a like ſituation.——Yawning ſeems occaſioned by an indolent diſpoſition, or preſent want of thought, and is commonly the prelude to ſleep; one perſon no ſooner ſhews ſuch a diſpoſition, but the reſt of the company catch it, and follow the example; and if another ſhew a diſpoſition for mirth, by laughter, the reſt immediately join him, though they may be ignorant of the motive.

It ſeems there may be other cauſes of yawning, than what have been mentioned by our correſpondents. For inſtance, the ſight of a picture of a perſon yawning, is found ſufficient to excite the ſenſation in others. So is alſo the bare ſpeaking, or thinking upon the ſame; of which the compiler of this work experienced a remarkable inſtance, being ſeized with an extraordinary fit of yawning, while he was writing moſt of the ſolutions of this query.

Query 6. *Anſwered by Mr G. Lodge, of Linton.*

It appears from Dr. Smith's Optics, p. 266, that a minute object cannot be magnified to infinity by a ſingle lens, though it were poſſible to make it as ſmall as we pleaſe, without ſome method of increaſing its light. Nevertheleſs, this imperfection in ſingle microſcopes, is not ſo great as at firſt ſight one would take it to be, as in fact we find it; and the reaſon may be, becauſe the eye is capable of diſcerning objects tolerably well, by about twenty thouſand different degrees of light, every degree being equal to the light by which we ſee objects in the brightneſs of moon-light. But though the brightneſs of the object were increaſed, by throwing new light upon it, yet Huygens obſerves, that the power of the microſcope would ſtill be limited by the breadth of the pencils that enter the pupil, which is equal to the breadth of the aperture. For if this breadth be leſs than $\frac{1}{5}$ or $\frac{1}{6}$ of a line, he affirms, that the edges of an object will begin to appear indiſtinct.—By double microſcopes this excellent author has made it appear, that we may magnify objects at pleaſure, provided it were poſſible to form the object glaſſes as ſmall as we pleaſe, ſince all other obſtructions may be removed.

The ſame, by Mr Tho. Croſbey, of Peaſehaulm.

Within the laſt century, there have been ſuch varieties both of ſingle and double microſcopes made, that it is really difficult to know which are the beſt. But Mr. Lewenhoek of Delft, in Holland, who is allowed by all writers on this ſubject to be one of the beſt judges of theſe inſtruments, prefers ſingle microſcopes to double ones, as may be ſeen in the account Martin Folkes, Eſq. gives of Mr. Lewenhoek's glaſſes, No. 380 of the Philoſ. Tranſactions. See alſo a further account of his glaſſes by Mr. Henry Baker, in No. 458, for the year 1740. Though Sir Iſaac Newton preferred the double one.

The ſame, by Mr J. Jackſon, of Hutton-Rudby School.

The double microſcope is undoubtedly the more proper for nice examinations of very minute objects, becauſe the parts ought to be magnified the moſt poſſible, to appear diſtinct. Now to have a ſingle microſcope to magnify any way nearly the ſame as a double one, the glaſs muſt be more ſpherical, and ſmaller than any in the double one, and in conſequence the aberration thence ariſing, will have a more ſenſible effect in rendering the object more indiſtinct in the ſingle than in the double microſcope, when the object appears nearly as large. Beſides the double one is commonly equipt with a mirror, by which the angle of incidence and reflection throws up light on the under ſide of the object, which being placed in the focus of a moveable lens, has its upper ſide enlightened alſo; ſo that the internal parts of tranſparent objects may be ſeen, ſuch as the circulation of the blood, *&c. &c.*

We are further obliged for Anſwers to the Queries, to Meſſieurs Anonymous, Rob. Barwick, Wm. Boyer, John Burrow, Ra. Burton, John Cairns, John Chapman, Rd. Cockrel, Joſ. Cowing, John Craggs, Tho. Crosbey, John, Dalton, Tho. Davis, Rd. Dening, Tho. Eland, J. Elliott, Tho. Elmer, A Goſportonian. John Griffith, John Heſlop, J. Hunt, John Jackſon, Nich. King, Tho. King, Tho. Leybourn, John Liddell, G. Lodge, J. Lowry, Henry Mellanby, Tho. Metcalfe, John Needham, Wm. Paul, Philochronos, Da. Robarts, Alex. Rowe, Billy Shortſhanks, Tho. Simpſon, John Singleton, Rob. Smith, James Spilling, Geo. Stevenſon, Vertigo, J. Walton, and Wm. Weatherill.

New REBUSES, CHARADES, *and* QUERIES.

V. REBUS, *By Mr Tho. Higham, of Lancaſter.*

The greateſt bleſſing Heaven beſtows on man,
And what was ſpent ere Time itſelf began;
A bird that pours her melancholy ſtrain,
When ſable night extends her dark domain;

What joins young Damon to his yielding fair;
And what to ſpring's gay ſeaſon we compare.
What makes the brave, the gen'rous Briton ſmile;
The firſt fair victim of deceitful guile,
And nature's wiſh when weary'd out with toil.
If now, ye fair, you can explain each line,
With niceſt art the initials pleaſe to join,
Then a ſweet bard, whoſe tuneful lays appear
In Diary's myſtic page, each circling year,
You'll name. 'Tis he who bids his genius ſoar,
And brightly ſhines in enigmatic lore.

VI. Rebus, *by Mr Tho. Leybourn, of North Shields.*

Take a creature a mixture of both beaſt and bird,
And what we a baſe villain call;
Then take an expreſſion that by us is us'd,
When ſudden in danger we fall:
Next a liquor that cheers and enlivens our ſouls,
And a God that rules o'er the main,
The initials of theſe, when join'd, will declare
A beautiful maid I would gladly obtain.

VII. Rebus, *by Dr Malſalgerate.*

Of metal found in bright Peruvian ſand,
And of an ore produc'd in Britiſh land,
Th' initials join'd to what we always find
The ſtupideſt among the beſtial kind,
Will form what oft reflects a beauteous face,
And what at jovial tables bears a place.

VIII. Rebus, *by Mr John Singleton, of Aſhton Free School, near Wigan.*

What Jews or Chriſtians for their ſabbath hold;
A well known beaſt that once did ſpeak of old;
Him whom old Neptune to a rock did turn,
What cauſes youths with languor oft to burn;
What, when 'tis gone, no one can back regain,
A famous robber by old Hercules ſlain;
Her whom Diana ſhot for too much pride;
A Grecian chief who by Ægiſtus dy'd;
A king of Thrace, by means of Dolon ſlain;
What muſt be us'd this rebus to explain:
Collect th' initials, then to you'll appear
A beauteous nymph, and one I moſt revere.

IV. Charade, *By Mr Thomas Eland, of Eaſt Row.*

The warbling Billington would chant in vain,
Unleſs my *firſt* approv'd the melting ſtrain.

My *next*, ſee Damon at the altar ſtand,
Prepar'd to place on lovely Delia's hand.
My *whole*'s an ornament, ye lovely fair,
And frequent wantons 'midſt your flowing hair.

V. CHARADE, *by Mr Thomas Higham, of Lancaſter.*

See, when " dread winter ſpreads his lateſt gloom,"
Array'd in white my *firſt* deſcending come!
Of richeſt grace to you, ye blooming fair;
My pendent *ſecond* gives a brilliant air.
Hail, lovely whole, to mortal view diſplay'd,
The ſweeteſt emblem of a baſhful maid!
Thou, ſhort-liv'd prophet, ſurely ſeem'ſt to ſing,
Go, ſhepherds, forth to meet the early ſpring.

VI. CHARADE, *by Mira.*

My *firſt*, ye fair, is gloomy, drear, and deep,
Seldom frequented by the young and gay,
O'er me ſad Mira frequent vigils keeps,
While Luna glimmers wan her ſilver ray.
My *ſecond*, hard, inflexible and ſtrong,
With fury oft, and rage impetuous hurl'd,
My *whole* diſtinction gives to old and young,
Fraught with inſtruction to an erring world.

VII. CHARADE, *by G. R.*

My *firſt* may juſtly boaſt its birth,
For all muſt grant that none on earth
Deſcends from higher race.
My *next*, in ancient times you'll find,
Was bent on miſchief, or inclin'd
To join the jovial chace.
My *whole* mankind do much admire,
And ſtill to heighten their deſire,
I ſeldom ſhew my face.

VIII. CHARADE, *by Strephon.*

Subſtantial, *firſt*, with which we e'en monarchs bind,
Yet in the us'rer's cheſt oft lies confin'd.
Enfeebled *ſecond*, that ev'ry ſtripling dreads,
Yet wiſh the mean that to thy ſtation leads.
Oppreſſive *whole*, may Britons never bear
Thy fell reſtraint, nor wretched enſigns wear.

III. QUERY, *by Mr Rob. Barwick of Ringſtead.*

What is the reaſon that corns, or caluſes, or rheumatic joints, give us pain juſt before change of weather ſtorms?

IV. QUERY, *by Mr Wm. P. Burman, of Beverley.*

It being a common and long-ſuppoſed notion, that if a feather-bed in part conſiſt of pigeons' feathers, or be wholly compoſed of them, no perſon dying upon it (as it is ſaid) can quit this life, or die ſo compoſedly, as on a bed made of gooſe feathers only? I ſhould be glad either to ſee this ſimple idea refuted, or elſe ſome good reaſon aſſigned for the notion.

V. QUERY, *by Mr Wm. Gradidge, of Canterbury.*

Are Yorkſhiremen more ſubtle and keen in their dealings than thoſe of other counties? or is the prevailing report of their being ſo, only an empty compliment?

VI. QUERY, *by Mr J. Walton, of Allen Town.*

As I have frequently ſeen clouds, in a fine ſummer morning, riſe higher and higher in the atmoſphere, till they entirely diſappeared, what could become of thoſe vapours?

*** *Other Enigmas, Rebuſes, Charades, &c. now omitted for want of room, will be inſerted in their turn hereafter.*

ANSWERS *to the* MATHEMATICAL QUESTIONS *propoſed in the laſt Supplement.*

I. Queſtion *anſwered by Mr J. Overend, of Tottenham.*

Firſt 30 × 3 = 90l. is the coſt of the whole 30 pieces,
and 20 × 3 = 60l. is the coſt of 20 pieces;
theref. 100 : 125 : : 90 : 112·5 the ſale of the whole,
and 100 : 150 : : 60 : 90 the ſale of the 20 pieces;
theref. their differ. 22·5 is the ſale of the 10 pieces;
conſeq. 10 : 1 : : 22·5 : 2·25l. or 2l. 5s. the ſale of each of the remaining 10 pieces, or the anſwer.

The ſame, by Miſs Harriott and Sally Pitts, pupils to Mr John Cavill.

It is plain, from the conditions of the queſtion, that the 20 pieces ſold returned the whole purchaſe-money, and therefore the whole gain muſt be equal to the ſale of the remaining 10 pieces.

But 100 : 90 : : 25 : 22·5l. the whole gain, or ſale of 10 pieces; hence the 10th part of it, or 2·25l. or 2l. 5s. is the price of each piece.

The ſame was alſo ingeniouſly anſwered by Meſſrs James Adams, John Aſhton, John Birch, A. Buchanan, junr. Ralph Burton Thomas, Cock, Rd. Cockrel, John Craggs, Tho. Croſbey, J. Elliott, Thomas Elmer, L. Evans, Olinthus Gregory, John Griffith, J. Hartley, John Heſlop, Tho. Higham, Nich. King, Ant. Lawſon, J. Liddell, J. Lowry, Mancunienſis, Tho. Metcalfe, John Needham, Peter Nicholſon, Da. Kinnebrook jun. Iſaac Saul, Merry Tom, Wm. Weatherill, and J. J. Willins.

II. Queſtion *anſwered by Mr J. J. Willins, at Mr George Stevenſon's School, at Howdon Dock, near North Shields.*

Call x the time required, $r = 1{\cdot}05$ the amount of 1 pound for 1 year, and $a = \frac{1}{240} l. = 1$ penny. Then ar^x is the amount of 1 penny at compound intereſt for x years, and $5x + 100$ is the amount of 100*l.* at ſimple intereſt for the ſame time. Therefore, by the queſtion, $ar^x = 5x + 100$, or $1{\cdot}05^x = 1200x + 24000$, or by taking the logarithms of theſe, it is $x \times \log.$ of $1{\cdot}05 = \log.$ of $\overline{1200x + 24000}$; and hence, by Double Poſition, is found $x = 260{\cdot}87171$ years, the time required.

Nearly in the ſame manner was the anſwer given by Meſſrs James Adams, James Aſhton, John Boden, A. Buchanan, junr. John Craggs, J. Elliott, John Griffith, J. Hartley, D. Kinnebrook jun. John Liddell, Mancunienſis, Tho. Metcalfe, and Merry Tom.

III. Queſtion *anſwered by Mr J. Birch, of Moulton.*

Let x denote the ſum in pounds ſaved in each year; then will $180 - x$ denote his annual ſpending. Now at the end of the firſt year x pounds is put out to intereſt, to continue 23 years, which intereſt will be $\frac{23}{20}x$; then every following year's ſaving will continue one year leſs than the former; ſo that $\frac{22}{20}x$ will be the intereſt on the ſecond ſaving, and $\frac{21}{20}x$ the intereſt on the third ſaving, and ſo on in arithmetical progreſſion, to the laſt term $\frac{1}{20}x$; therefore the ſum of this ſeries is $\overline{\frac{23}{20}x + \frac{1}{20}x} \times \frac{23}{2} = \frac{276}{20}x$ which is the ſum of all the particular intereſts; and this added to $24x$, or the whole 24 years ſavings, makes $\frac{276}{20}x + 24x = \frac{756}{20}x$ for the whole ſum accumulated.

But, by the queſtion, the yearly intereſt of this amount muſt be equal to $180 - x$, or his annual expence, that is, $\frac{1}{20}$ of $\frac{756}{20}x = 180 - x$, or, $\frac{756}{400}x = 180 - x$; hence then $1156x = 72000$, and $x = \frac{72000}{1156} = 62\frac{82}{289} = 62l.\ 5s.\ 8d.$ the ſum ſaved each year.

This taken from - 180 0 0
leaves 117 14 4 for his rate of living.

Hence $\frac{756}{20}x$ or $\frac{378}{10}x = 2354l.\ 6s.\ 6d.$ is the ſum accumulated.

The ſame anſwered by Mr John Griffith, of Sandbach.

Put $x =$ the ſum ſpent each year; then $180-x$ will be his yearly ſaving, and in 24 years he will ſave $4320-24x$, beſides the annual intereſts, which will be the ſum of an arithmetical progreſſion, from 23 years to 1 year, and in all, amounts to $2484-13{\cdot}8x$: now this ſum added to the former, makes $6804-37{\cdot}8x = 20x$ by the queſtion. Hence $x = \frac{6804}{57{\cdot}8} =$ 117·716 the annual expence required; and hence 2354·32 is the ſum accumulated.

Nearly in the ſame manner was the ſolution given by Meſſrs James Adams, James Aſhton, A. Buchanan junr. Ra. Burton, Rd. Cockrel, John Craggs, Tho. Crosbey, J. Elliott, Tho. Elmer, Olinthus Gregory, J. Hartley, Da. Kinnebrook, junr. John Liddell, Mancunienſis, Tho. Metcalfe, Peter Nicholſon, Miſs Harriot and Sally Pitts, J. Saul, Merry Tom, Wm. Weatherill, James Wilding, and J. J. Willins.

IV. Queſtion, *anſwered by Mr D. Kinnebrook, junr. of Norwich.*

In this queſtion are given the firſt term 6, the laſt term 5000000, and the number of terms 301, (for there are 300 years or terms after the firſt term 6), of a geometrical progreſſion, to find the common ratio; which by the nature of the progreſſion, will be eaſily found to be $\sqrt[300]{\frac{5000000}{6}}$; or in logarithms, the log. of r the ratio is $\frac{\log.\ 5000000 - \log.\ 6}{300}$ $= {\cdot}01973606$, and the number anſwering to this is $1{\cdot}0465 =$ r the ratio of increaſe as required. And according to this rate the numbers will be doubled always in about $16\frac{3}{10}$ years; for $n - 1 = \frac{\log.\ 2}{\log.\ r} = \frac{\log.\ 2}{\log.\ 1{\cdot}0465} = 15{\cdot}304$, and $n = 16{\cdot}304$ the number of terms, when the laſt term is double the firſt.

Other ſolutions were given by Meſſrs James Adams, James Aſhton, John Birch, John Craggs, J. Elliot, Olinthus Gregory, John Griffith, Tho. Metcalfe, Iſaac Saul, Wm. Weatherall, J. J. Willins.

The ſame anſwered by Mancunienſis.

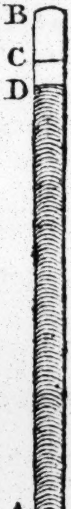
When the lengths of pendulums are all equal, the forces of gravity are as the ſquares of the number of vibrations, therefore $60^2 : 2^2 : 1 : \frac{1}{900}$; but the forces of gravity are reciprocally as the ſquares of the diſtance from the earth's centre, therefore $1 : \frac{1}{900} :: 1^2 : 30^2$; therefore the diſtance from the centre is 30, and above the ſurface 29 radii of the earth.

V. Queſtion *anſwered by Mr J. J. Willins, at Mr George Stevenſon's School, at Howdon Dock.*

This queſtion is ſimilar to the 155th of the Diarian Miſcellany, and may be readily reſolved by the Corollary there added by Dr. Hutton.—Here $t = 1440$ min. and $l = 1392$ min. loſt, whoſe difference is 48; then 48 : 1392 :: 1 radius : 29 radii of the earth, the height above the ſurface, as required.

Ingenious anſwers to this queſtion were alſo given by Miſſes H. and S. Pitts, and by Meſſrs James Adams, James Aſhton, John Birch, A. Buchanan, junr. Ralph Burton, Tho. Cock, Rd. Cockrel, John Craggs, Rob. Dowden, J. Elliott, John Griffith, J. Hartley, John Heſlop, Da. Kinnebrook, junr. Ant. Lawſon, John Liddell, Tho. Metcalfe, John Needham, and Iſaac Saul.

Queſtion VI. *anſwered by Mr Tho. Cock*, Teacher of the Mathematicks and Natural Philoſophy, at Cirenceſter.*



The compreſſive and elaſtic force of the air may be expreſſed by the height of the mercury in the barometer, or by the correſponding height of a column of water; and the ſpace occupied by the dilated air in the tube, will always be inverſely as that force. Then, the whole length of the tube AB being 32 inches, let BC be = 2 inches the length the included air would occupy in its natural ſtate, and BD the length really occupied in its diluted ſtate, AD being the height of the ſuſpended water; alſo, if 13·762 denote the ratio of water to quickſilver, then $13·762 \times 29 = 399$ nearly is the height of the column of water correſponding to the 29 inches of mercury. Hence then BD : BC or 2 :: 399 : $\frac{798}{BD}$ which will be the force of the air included in BD; to which adding AD or AB − BD, or 32 − BD, gives $\frac{798}{BD} + 32 - BD$ for the preſſure both of the water AD and air DB. But this muſt be equal to 399, the whole external force of the atmoſphere; therefore $399 = \frac{798}{BD} + 32 - BD$, or

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* *The author of the Diary returns thanks to Mr Cock for the preſent of his ingenious and uſeful "Synopſis of the Dimenſions of the Solar Syſtem," printed on a ſheet of paper.*

$367 = \frac{798}{BD} - BD$; which reduces to this quadratic equation $BD^2 + 367\,BD = 798$; the root of which is $BD = 2{\cdot}1617$ the diſtance of the water from the top of the tube.

But had mercury been uſed inſtead of water, with the ſame dimenſions, then would BD have been equal to 9·2621 inches.

This queſtion was alſo anſwered by Meſſieurs *James Adams, James Aſhton, John Craggs, Mat. Fleck, John Griffith, Da. Kinnebrook, junr. Mancunienſis, and Tho. Metcalfe.*

ANSWERS *to the* MATHEMATICAL QUESTIONS, *propoſed in the laſt Year's Diary.*

I. *Queſtion* 893, *anſwered by Mr James Adams, of Eaſt Stonehouſe.*

Put $p = 900$ the principal, $a = 87{\cdot}2575$ the amount for 1 year of $83\frac{1}{2}$ the annuity, $R = 1{\cdot}045$ the amount of 1 pound for 1 year, and t the time ſought. Then, becauſe R multiplied by any principal, gives the amount of that principal for 1 year, and ſince from the amount of any debt for a year, the amount of the annuity being taken away, there remains the next year's debt, &c. therefore, by making theſe ſubtractions we obtain the ſeveral years debts or remainders as follows, viz.

$pR - a$ - - - - debt at the end of 1 year,

$\overline{pR - a} . R - a$ - - - of 2 years,

$\overline{\overline{pR - a} . R - a} . R - a$ - - - - of 3 years,

&c. that is,

$pR - a$ - - - - due after 1 year,

$pR^2 - aR - a$ - - - 2 years,

$pR^3 - aR^2 - aR - a$ - - - - 3 years,

$pR^4 - aR^3 - aR^2 - aR - a$ - - - 4 years,

&c. till

$pR^t - aR^{t-1} - aR^{t-2} - aR^{t-3} \ldots\ldots - a$ t years.

or $pR^t - a \times : 1 + R + R^2 + R^3 \ldots\ldots R^{t-1}$ is equal to the ſame debt due after t years; but the ſum of the geometrical ſeries $1 + R + R^2$ &c. is $\frac{R^t - 1}{R - 1}$, and becauſe the debt is ſuppoſed to be all diſcharged after t years, therefore the above expreſſion muſt be equal to nothing, that is $pR^t - \frac{R^t - 1}{R - 1} \times a = 0$, or $pR^t = \frac{R^t - 1}{R - 1} \times a$, conſequently, $R^t = \frac{a}{p + a - pR} =$

$\frac{a}{a-pr}$, putting $r = \text{R} - 1 = {}^{\cdot}045$, and $t = \frac{\log. a - \log. \overline{a-pr}}{\log. \text{R}}$ $= 14{\cdot}174$ years, the time ſought in this caſe.

According to one or other of the three different ways, was the ſolution given by Meſſieurs Amicus, James Aſhton, John Bickford, John Birch, Geo. Brown, A. Buchanan, junr. J. Burrow, John Cavill, Joſ. Cowing, John Craggs, Tho. Croſbey, John Dalton, Rob. Dowden, J. Elliott, Tho. Elmer, L. Evans, Matt. Fleck, John Griffith, James Hannah, J. Hartley, John Haycock, J. Jackſon, Nich. King, Da. Kinnebrook, junr. Ant. Lawſon, Tho. Lewis, Tho. Leybourn, John Liddell, J. Lowry, Mancunienſis, Tho. Metcalfe, Joſ. Nendich, Peter Nicholſon, Pariſh Clerk of Heſſle, W. Paſsman, Wm. Pearſon, Quadraticus, Alex. Rowe, John Ryley, J. Saul, Joſ. Slack, Mat. Terry, Wm. Thomſon, J. Walton, W. Weatheriil, T. White, A. Whitehouſe, S. Woolcott, and Joſ. Youle.

III. Queſtion 895, *anſwered by Mr Alex. Rowe, of Reginnis.*

Let $2x^2$ denote the firſt ſum with which the merchant began trade. Then $4x^2$ will be the amount in 3 years,
$4x^2+2x+10$ the amount in 4 years,
$\overline{4x^2+2x+10}|^2$ the amount in 7 years,
Theref. $\overline{4x^2+2x+10}|^2 = 62500$, by the queſtion,
Hence $4x^2+2x+10 = \sqrt{62500} = 250$, and $x = 7\frac{1}{2}$
Conſeq. $2x^2 = 112\frac{1}{2} = 112$*l.* 10*s.* is the ſum ſought.

The ſame by Mr John Holland, of Adderbury Boarding School.

Put x for the firſt ſum. Then will
$2x$ be the amount after 3 years,
$2x+\sqrt{2x}+10$ the ſame after 4 years, and
$\overline{2x+\sqrt{2x}+10}|^2 = 62500$ the ſum after 7 years,
Hence $2x+\sqrt{2x}+10 = \sqrt{62500} = 250$
or $2x+\sqrt{2x} = 240$
Conſeq. $x = 112\frac{1}{2}$ the ſum at the beginning.

Ingenious Anſwers were alſo given by Meſſieurs James Adams, Amicus, James Aſhton, Wm. Bell, B. Benſon, John Bickford, John Birch, John Boden, Geo. Brown, A. Buchanan, junr. John Burrow, Ra. Burton, John Cavill, Rd. Cockrel, Joſ. Cowing, John Craggs, Tho. Croſbey, John Dalton, Rd. Dening, Rob. Dowden, Eliſha Dunton, J. Elliott, Tho. Elmer, L. Evans, Evoc Egroeg Semaj, A. Goſportonian, Olinthus Gregory, John Griffith, Iſaac Gumley, James Hannah, J. Hartley, John Haycock, Tho. Higham, J. Holder, N. Hoſkins, J. Jackſon, Nich. King, Da. Kinnebrook, junr. Ant. Lawſon, Tho. Lewis, Tho. Laybourn, John Liddell, John Lomax, J. Lowry, Mancunienſis, Tho. Metcalfe, Tho. Milner, Cuth. Naizby, Peter Nicholſon, J. Overend, Pariſh

Clerk of Heſſle, W. Paſſman, Wm. Pearſon, W. Plaſted, C. Pritty, Quadraticus, Bob. Quadraticus, Wm. Quaiſe, T. R. of B, John Ryley, J. Saul, oe Sherwin Joſ. Slack, Joſ. Spilling, G. Stevenſon, Mat. Terry, Wm. Thomſon, Wm. Tomlinſon, Tho Truſwell, Myton Tweedell, W. Virgo, John Walch, J. Walton, W. Weatherill, R. G. Weſt, Tho. White, A. Whitehouſe, S. Woolcott, and Joſeph Youle.

IV. Queſtion 896, *anſwered by Mr Da. Kinnebrook, junr. of Norwich.*

Let DABE be the conical veſſel [*See the fig. pa. of the Diary*] and DCE the immerſed cone. Then, the radius DF being given $= 20$ inches, and the convex ſuperficies of the cone DCE $= 2827{\cdot}44$ inches, we have $DC \times DF \times 3{\cdot}1416 = 2827{\cdot}44$, whence $DC = \frac{2827{\cdot}44}{20 \times 3{\cdot}1416} = 45$ the ſlant ſide of the cone. And ſince the area of the circle ACB is alſo given $= 2827{\cdot}44 = {\cdot}7854 AB^2$, we have the top diameter $AB = \sqrt{\frac{2827{\cdot}44}{{\cdot}7854}} = 60$. Or thus, becauſe the ſurface of the cone $3\ 1416 \times DC$ is $=$ the area of the top or $3{\cdot}1416\, AC^2$, therefore $DF \times DC = AC^2$, or $AC = \sqrt{DF \times DC} = \sqrt{20 \times 45} = 30$ a mean proportional between DF and DC. Then $CF = \sqrt{DC^2 - DF^2} = \sqrt{1625} = 40{\cdot}3112$ the perpendicular height of both the cone and veſſel. Hence the content of the fruſtum DABE is $\overline{AB^2 + DE^2 + AB \times DE} \times \frac{1}{3} CF \times {\cdot}7854 = 80206{\cdot}3884$ inches $= 284{\cdot}4198$ ale gallons; and that of the cone DAEF is $DE^2 \times \frac{1}{3} CF \times {\cdot}7854 = 16885{\cdot}5396$ inches $= 59{\cdot}8778$ gallons, the quantity that overflowed.

COROL. Hence AC is a mean proportional between DC and DF, when the area of the top is equal to the convex ſurface of the cone. And in all caſes, the ſolid DACEB, or the difference between the fruſtum and the inſcribed cone, is equal to $\overline{AB^2 + AB \times DE} \times \frac{1}{3} CF \times {\cdot}7854$.

Nearly in the ſame manner the ſolution was given by Meſſrs Amicus, James Aſhton, B. Benſon, John Bickford, John Birch, J. Boden, Geo. Brown, A. Buchanan, John Burrow, Ra. Burton, John Cavill, Joſ. Cowing, John Craggs, Tho. Croſbey, John Dalton of Kendal, John Dalton of South Cave, Rob. Dowden, Eliſha Dunton, J. Elliott, L. Evans, Matt. Fleck, O. Gregory, John Griffith, Iſaac Gumley, James Hannah, J. Hartley, John Haycock, Tho. Higham, John Jackſon, Nich. King, Ant. Lawſon, Tho. Lewis, Tho. Leybourn, John Liddel, Cuth. Naizley, Peter Nicholſon, Pariſh Clerk of Heſſle, W. Paſſman, Wm. Pearſon, C.

Pritty, Quadraticus, T. R. of B, Alex. Rowe, John Ryley, J. Saul, Ra. Simpſon, Joſ. Slack, Geo. Stevenſon, Matt. Terry, Wm. Thomſon, Wm. Tomlinſon, Wm. Virgo, J. Walton, W. Weatherill, R. G. Weſt, Tho. White, A. Whitehouſe, S. Woolcott, Tho. Woolſton, and Joſ. Youle.

V. Queſtion 897, *anſwered by Mr Joſeph Youle, School Maſter, near Sheffield.*

Let $a =$ the velocity of a before the ſtroke, or $\frac{4}{5}a$ its velocity after it, and $x =$ the velocity of B acquired by the ſtroke. Then $x - \frac{4}{5}a = a$ by Mechanics, becauſe the difference of the velocities after the ſtroke is equal to the velocity before; hence $x = \frac{9}{5}a$. Again, by mechanics, the motion before the ſtroke is equal to the motion after, that is $a\text{A} = \text{B}x + \frac{4}{5}a\text{A}$, or $\frac{1}{5}\text{A}a = \text{B}x - \frac{9}{5}\text{B}a$, and hence $\text{A} = 9\text{B}$, the proportion ſought.

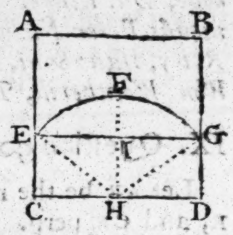
True anſwers were alſo given to this queſtion by Meſſieurs James Adams, Amicus, James Aſhton, John Cavill, A. Buchanan, Junr. John Dalton of South Cave, John Griffith, Tho. Harriſon, John Haycock, John Jackſon, Da. Kinnebrook junr. N. King, Ant. Lawſon, John Liddel, Mancunienſis, Peter Nicholſon, Pariſh Clerk of Heſſle, W. Paſſman, C. Pritty, John Riley, J. Saul, Geo. Stevenſon, Matt. Terry, Wm. Tomlinſon, Tho. White, and A. Woodhouſe.

VII. Queſtion 899, *anſwered by Mr J. Cowing, of Newcaſtle.*

The probability of throwing all heads or all tails with 5 pieces, is $\frac{2}{32}$ or $\frac{1}{16}$, and that of miſſing is $\frac{15}{16}$; therefore the probability of miſſing all heads or all tails, in 4 throws, is $\frac{15}{16} \times \frac{15}{16} \times \frac{15}{16} \times \frac{15}{16} = \frac{50625}{65536}$; and the probability of hitting once or oftener, in 4 throws, is $\frac{14911}{65536}$; conſequently A's ſtake to B's ought to be 50625 to 14911, to have an equal chance to win; ſo that if A's ſtake be 5*l*. 5*s*. then B's ſhould be nearly 1*l*. 11*s*.

True ſolutions were alſo given by Meſſieurs Amicus, James Aſhton, John Dalton of Kendal, John Haycock, Tho. Leybourn, Pariſh Clerk of Heſſle, Wm. Pearſon, and S. Woolcott—But moſt of the other numerous contributors, limited the coming up of all heads or all tails, to once preciſely, and no more, which cauſed their anſwers to differ from thoſe above.

VIII. Queſtion 900, *anſwered by Mr Rob. Dowden, of Woolavington.*



Suppoſe ABCD the given ſquare, and CEFGD the part to be cut off equal to half the ſquare. Put $a = 6$ the half ſide HC, or $c = 72$ the half area, $x =$ the radius HE or HF. Then HI = CE = $\sqrt{x^2 - a^2}$, and $2a\sqrt{x^2 - a^2}$ is the area of the parallelogram CEIGD; then, after finding the area of the ſegment, &c. nearly as in the laſt ſolution in the Diary, Mr Dowden next finds the ſame by infinite ſeries, as the more accurate way, thus: by rule 3 Hutton's Menſuration, pa. 124, ſecond edit.

$$a + \frac{a^3}{6x^2} + \frac{3a^5}{40x^4} + \frac{5a^7}{112x^6} \text{ \&c.} = \text{the arc EF, and}$$

$$ax + \frac{a^3}{6x} + \frac{3a^5}{40x^3} + \text{\&c. is the area of the ſector}$$

HEFG; alſo $a\sqrt{x^2 - a^2} =$

$$ax - \frac{a^3}{2x} - \frac{a^5}{8x^3} - \frac{a^7}{16x^5} \text{ \&c.} = \tfrac{1}{2} \text{ the paral. CEGD}$$

or = 2 tri. CEH + DGH;

$$\text{Therf. } 2ax - \frac{a^3}{3x} - \frac{a^5}{20x^3} - \frac{a^7}{56x^5} \text{ \&c. or the ſum is} = c = 72,$$

$$\text{or} \quad x - \frac{6^2}{6x} - \frac{6^4}{40x^3} - \frac{6^6}{112x^5} \text{ \&c.} = 6$$

and hence $x = 6{\cdot}994$ nearly, the radius ſought.

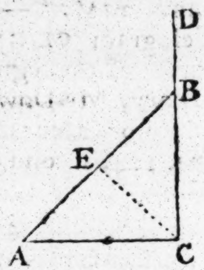
The ſame by Mr J. Jackſon, of Hutton-Rudby School.

Let the radius EH = x, EI = CH = $\frac{1}{2}$ CD = $6 = a$. Then, by Dr Hutton's firſt rule for finding the length of the arc EFG, as x (EH) : a (EI) :: 1 (radius) : $\frac{a}{x}$ natural ſine of ∠EHI, the degrees anſwering to which call m, alſo $\cdot 01745329 = c$; then is $cmx =$ the arc EF, and therefore cmx^2 the area of the ſector HEFG.——Again CE = $\sqrt{x^2 - a^2}$, and CE × CH = $a\sqrt{x^2 - a^2}$ is the area of the two triangles, CEH + DGH; conſequently the ſum, $cmx^2 + a\sqrt{x^2 - a^2}$ = CEFGD = 72 by the queſtion, which is eaſily reſolved by a table of natural ſines, by which x is found = 7 very nearly.

Various other true and ingenious ſolutions were given by Meſſrs J. Adams, Amicus, James Aſhton, John Bickford, John Boden, A. Buchanan, junr. John Burrow, John Cavill, John Craggs, Tho

Croſbey, John Dalton of Kendal, John Dalton of South Cave, Goſportonian, John Griffith, Wm. Hardy, J. Hartley, John Haycock, Da. Kinnebrook, junr. Ant. Lawſon, John Liddel, Mancunienſis Peter Nicholſon, Pariſh Clerk of Heſſle, W. Paſſman, John Ryley, Iſaac Saul, Geo. Stevenſon, Wm. Thomſon, Tho. Truſwell Wm. Weatherill, Tho. White, S. Woolcott, and Joſeph Youle.

IX. Queſtion 901, *anſwered by Mr John Haycock, of Ware.*



Let AB be the rope fixed to the tree CD at B, and CE perp. to AB. Then, by mechanics, the effect of the force in AB, to break the tree at C, is as CB × ſine $\angle$B, that is, ſince AC is as the ſine of the angle B when the hypothenuſe AB is given, the effect is as AC × CB, or as the area of the triangle ABC, which is alſo as AB × CE which is equal to the double area; but AB is given, and therefore the effect is ſimply as the perpendicular CE of the right-angled triangle ABC having the hypothenuſe AB given; which effect being a maximum, the perp. CE muſt be a maximum, and conſequently muſt ſtand upon the middle of the hypothenuſe, making the triangles on both ſides of it equal in all reſpects. Conſequently the $\angle A = \angle B =$ half a right angle, and the height BC = the diſtance $AC = AB\sqrt{\frac{1}{2}} = 49\frac{1}{2}$ nearly.

True and ingenious ſolutions were alſo given by Meſſieurs Ja. Adams, Amicus, John Birch, John Boden, Geo. Brown, John Barrow, Ra. Burton, John Cavill, Rd. Cockrel, John Craggs, John Cullyer, John Dalton, J. Elliott, John Griffith, John Jackſon, Nic. King, Da. Kinnebrook, junr. Tho. Leybourn, John Liddel, Wm. Mudge, Pariſh Clerk of Heſſle, John Ryley, Tim. Simpſon, Joſ. Slack, Ja. Spilling, Geo. Stevenſon, Mat. Terry, Tho. White, A. Whitehouſe, and S. Woolcott.——Other anſwers were received, but they were not right.

X. Queſtion 902, *anſwered by Mr John Dalton, of South Cave.*

Put x = the number expreſſing the ſide of the cube, and y^2 = the ſum of its digits. Then by the firſt condition of the queſtion, $6x^2 = 864y^2$, and therefore $x = 12y$. By the ſecond condition $x^3 = 576y^4$, or $12^3y^3 = 576y^4$; hence $y = \frac{1728}{576} = 3$. Conſequently x, or $12y$, $= 36$, the ſide of the cube.

The ſame anſwered by Quadraticus.

Let x = the ſide of the cube, and s = ſum of the digits in x. Per queſt. $6x^2 = 864s$, or $x^2 = 144s$, and $x = 12\sqrt{s}$.

Alſo, per queſt. x^3 or $12^3 s^{\frac{3}{2}}, = 576s^2$, whence $\sqrt{s} = 3$, and $x = 12\sqrt{s} = 36$ inches.

OTHERWISE. Put x and s as before. Per queſt. $6^2 = 864s$, and $x = 12\sqrt{s}$. Therefore s is a ſquare number which, by the queſtion, is between 2 and 18 : x is therefore a multiple of 12 either by 2, 3, or 4, that is, $x =$ either 24, 36, or 48. But the ſums of the digits of theſe numbers, viz. 6, 9, and 12, are none of them ſquare numbers except 9 ; therefore $x = 36$. And thus the queſtion is anſwered, without conſidering the ſecond condition $x^3 = 576s^2$.

OTHERWISE again. x and s being ſtill as before, the ſecond condition is $x^3 = 576s^2 = 64 \times 3^2 s^2$, and $x = 4 \times \overline{3s}|^{\frac{2}{3}}$. So that $3s$ is a cube ; and ſince s cannot exceed 18, $3s$ muſt be a cube not exceeding 54 and diviſible by 3. But no cube leſs than 54 is diviſible by 3 except 27 ; therefore $3s = 27$, and $x = 4 \times \overline{3s}|^{\frac{2}{3}} = 4 \times 9 = 36$. And ſo the queſtion is anſwered without conſidering the firſt condition $6x^2 = 864s$.

Ingenious ſolutions upon one or other of the foregoing principles, were alſo given by Meſſieurs James Adams, Amicus, James Aſhton, Wm. Bell, B. Benſon, John Boden, Geo. Brown, A. Buchanan, junr. John Burrow, John Cavill, Joſ. Cowing, John Craggs, Tho Croſbey, John Dalton, Eliſha Dunton, J. Elliott, Olin. Gregory, John Griffith, Iſaac Gumley, James Hannah, John Haycock, John Jackſon, Da. Kinnebrook, junr. Ant. Lawſon, Tho. Leybourn, John Liddell, John Lomax, J. Lowry, Mancunienſis, Peter Nicholſon, I. Overend, Pariſh Clerk of Heſſle, W. Paſsman, W. Pearſon, W. Plaſted, C. Pritty, T. R. of B, A. Rowe, J. Ryley, J. Slack, Geo. Stevenſon, Matt Terry, Wm. Thomſon. Tho. White, W. Virgo, John Walch, J. Walton, R. G. Weſt, Tho. Truſwell, A. Whitehouſe, S. Woolcott, Tho. Woolſton, and Joſ. Youle.

XI. Queſtion 903, *anſwered by Mr Tim. Simpſon of Papplewick.*

Put $n = 32\frac{1}{6}$ feet, and $x =$ any variable abſciſſa of the diameter of the aperture perpendicular to the horizon ; then will $\sqrt{x - x^2}$ (calling the diameter 1) expreſs the correſponding ordinate, and $\sqrt{nx}$ the velocity of the ſtream per ſecond, ſuppoſing it equal to that acquired by a body deſcending freely through the ſpace $\frac{1}{2}x$; which being drawn into the ordinate, gives $x\sqrt{n - nx}$. Thus far being premiſed, the quantity of water may, in a very ſimple manner, be nearly eſtimated by the method of equidiſtant ordinates, as laid down by Dr Hutton in his excellent book of menſuration (pa. 490, ſecond edition) without fluxions. For admit the ſaid diameter to be divided into any even No. of equal parts, as 20; then taking x ſucceſſively $= 0, \frac{1}{20}, \frac{2}{20}, \frac{3}{20}$, &c. . . . to $\frac{20}{20}$, the expreſſion $x\sqrt{n-nx}$ will become reſpectively the numbers in the margin, taken from the top ſucceſſively to the bottom of the diameter. Here the ſum of the firſt and laſt numbers is $0 = \text{A}$, ſum of the 2d, 4th, 6th, &c. numbers $= 15{\cdot}25434 = \text{B}$, and the ſum of all the reſt $= 14{\cdot}82456 = \text{C}$;

00000
27640
53806
78434
1·0146
1·2280
1·4236
1·6004
1·7573
1·8928
2·0053
2·0926
2·1523
2·1810
2·1746
2·1269
2·0292
1·8671
1·7296
1·2048
0·0000

therefore $\frac{\text{A}+4\text{B}+2\text{C}}{3} \times \frac{1}{20} = 1{\cdot}511108$; which being doubled gives 3·022216 feet, the quantity of water iſſuing through the aperture every ſecond; which being multiplied by 3600, the ſeconds in an hour, give nearly 10880 cubic feet, the anſwer.

True anſwers were alſo given by Meſſieurs Amicus, John Haycock, Wm. Mudge, and the Pariſh Clerk of Heſſle. The other anſwers received were not right.

XII. Queſtion 904, *anſwered by the propoſer, Mr Bonnycaſtle.*

This queſtion will be beſt anſwered, by ſhewing that no equation whatever, above a ſimple one, which has its exponents, coefficients, and the abſolute term whole numbers, can have a finite fractional root. And for this purpoſe little more is neceſſary to be proved, than that if two numbers be prime to each other, any powers of them will alſo be prime to each other; a truth which is demonſtrated by Euclid in the 7th book of the Elements, and which is, indeed, nearly ſelf-evident. For, as any powers of prime numbers, are compounded *only* of factors which are the ſame as the numbers themſelves, it is plain that none of theſe factors can be common to each product, becauſe, by the hypotheſis, they are prime to each other; whence the products or powers themſelves, muſt alſo be primes.

To apply this to the queſtion, let us take the general equation $x^n \pm ax^{n-1} \pm bx^{n-2} \pm cx^{n-3} \cdot - - - - \pm qx = p$; where the exponents, coefficients, and abſolute term p are all whole numbers. And in order to try whether x can be equal to any vulgar fraction, let it be aſſumed equal to $\frac{y}{z}$, y and z being whole prime numbers.

Then by ſubſtituting $\frac{y}{z}$ for its equal x, we ſhall have

$$\frac{y^n}{z^n} \pm a.\frac{y^{n-1}}{z^{n-1}} \pm b.\frac{y^{n-2}}{z^{n-2}} \pm c.\frac{y^{n-3}}{z^{n-3}} \&c. \ldots \pm q.\frac{y}{z} = p;$$

and by multiplying by z^{n-1}, it is

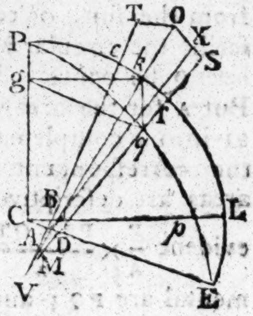
$$\frac{y^n}{z} \pm ay^{n-1} \pm by^{n-2}z \pm cy^{n-3}z^2 \&c. \ldots \pm qyz^{n-2} = pz^{n-1};$$

or $\frac{y^n}{z} = pz^{n-1} \mp ay^{n-1} \mp by^{n-2}z \mp cy^{n-3}z^2$ &c. …… $\mp$ qyz^{n-2}

But $\frac{y^n}{z}$ is an irreducible fraction ; and all the terms on the right hand ſide of the equation are whole numbers, by the premiſes. The former, therefore, cannot be equal to the latter ; and of conſequence no root of the equation can be a finite fraction ; for the ſame reaſoning will hold whether $\frac{y}{z}$ be poſitive or negative. If ſome of the terms in the equation be wanting, it is only to multiply by a different power of z, and the proof will be the ſame. Thus, in the equation propoſed, $x^3 - 15x = 3$, let $x = \frac{y}{z}$ as before ; then $\frac{y^3}{z^3} - \frac{15y}{z} = 3$; or $\frac{y^3}{z^2} - 15y = 3z$; or $\frac{y^3}{z^2} = 3z + 15y$; that is an irreducible fraction equal to a whole number, which is abſurd.

All our other correſpondents that have attempted the ſolution of this queſtion, are of the opinion, that ſuch equations do not admit of rational fractions for their roots, but failed in the general proof of it.

XIV. Queſtion 906, *anſwered by Amicus.*

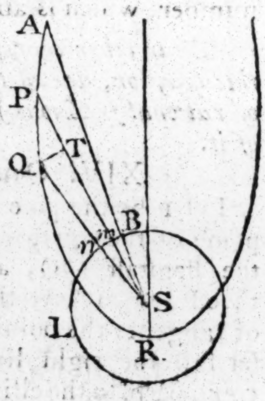


Let P be the pole of the earth, CLE the plane of the equator, PqE the meridian of the flagſtaff (qs), and PrL that of the theodolite at Tr; then by the property of tangents the points q and r are given ; let fall the right line TrA in the plane CPrL perp. to the ellipſe PrL at r, and interſecting CL in A ; and sqD perp. to the ellipſe PqE in the plane CPqE cutting CE in D. Through the line sqD ſuppoſe a plane drawn perp. to the plane CPrL and cutting it in the right line MBkO cutting sqB produced in M, and TrA produced in V, then qk being let fall perp. to MO muſt be perp. to gk (gq being parallel to CE) and gk parallel to CL ;

alſo BD is perp. both to MO and CL. By the property of the ellipſis the points D and A where the normals cut the axes are given, conſeq. CA and CD are given, as alſo *r*A and *q*D; in the right-angled ſim. triangles CBD, *gkq*, right-angled at B and *k* are given CD, *gq* and $\angle BCD = kgq = 30'$, hence BD, CB, *qk* and *gk* are given, conſeq. $AB = CB - CA$ is given. Draw, in the triangle *k*M*q*, BY parallel to the hypoth. M*q* cutting *qk* in Y, then $kY = kq - BD$ is given, and BY parallel to *q*D is given, conſeq. B*k* and $\angle kBY = kMq$ is given: let fall *kp* perpr. to CL, then $kp = Cg$, and hypoth. B*k* are given, hence the $\angle kBp = ABV$ becomes known, but the $\angle rAB =$ the lat. of the theodolite is given, therefore BAV, ABV, and AB being given, the triangle is given, AV, VB and $\angle AVB$ are given. Draw TO perp. to VT cutting VB*k* produced in O, then in the triangle OTV are given VT and the angles, whence TO and VO are given, and conſeq. $kO = VO - VB - Bk$ is given, or BO is given; at O erect OS perp. to the plane TOVCP*r* cutting D*q* produced in S, and BY produced in X, then in the triangle BOX right-angled at O are given BO and the angles whence OX is given, and conſeq. $OS = OX + BD$, then, in the right-angled triangles TOS are given the legs OT and OS, to find the angle OTS, which is that required.

A true and ingenious ſolution was alſo given by Mr S. Woolcott.

XV. *Or Prize Queſtion anſwered by the Rev. Mr Wm. Sewell, A. M. of Northwalſham.*



Let APR repreſent any portion of the comet's orbit; A the place from which we are to reckon the commencement of the time; P the place of the comet at any inſtant afterward. With radius 1, repreſentative of the earth's mean diſtance from the ſun, or center of force S, deſcribe the circular arc BL: draw SP, and let SQ be conceived indefinitely near it. Put A for the area deſcribed, by the ray SP in one complete revolution, and P for the correſpondent period: then as the areas are deſcriptive of the times, it is evident $\frac{P}{A} \times \frac{PS \times QT}{2}$ will be the time of deſcribing the incremental arc PQ; and as the heat received is as its intenſity and time conjunctly, we have $\frac{q}{PS^2} \times \frac{P}{A} \times \frac{PS \times QT}{2}$, or $\frac{qP}{2A} \times \frac{QT}{PS}$, or its equal $\frac{qP}{2A} \times mn$, for the incremental quantity of heat received in the ſame time; and conſequently the integral quantity itſelf, received by the comet in its paſſage through AP, will be truly defined by $\frac{q\text{P}}{2\text{A}}\times$ circular arc Bm. And therefore the heat received in half a revolution is $\frac{q\text{P}}{2\text{A}}\times 3\cdot14159$, let the figure of the orbit be what it may. Now the quantity of heat received by an equal magnitude of the earth's diſk in the ſame time, is evidently $\frac{q\text{P}}{2}$; therefore the heat of the earth will be to the heat of the comet in its perihelion : : A : area of a circle whoſe radius is 1, or as 121 to 1 nearly*, ſuppoſing no heat to be loſt, but to be uniformly diſperſed throughout the ſubſtance of each body.

Scholium. From this theorem it may readily be adduced, that the heat received by the great comet of 1680, during one of its periods, does not exceed above $\frac{1}{80}$th of the quantity which our earth receives in the ſame time, notwithſtanding the denſity of the ſolar rays acting upon its ſurface, when in the perihelion, is 2000 times greater than ſufficient to heat iron red hot; and in reſpect to the comet in queſtion, is more than twice ſufficient for that purpoſe. Whence we learn, that the heat, received by comets, upon the whole, falls far ſhort, *cæteris paribus*, of that received by our earth.

It is to be noted, it is not the whole body or maſs of the comet that can be heated to the degree above mentioned, but the matter near the ſurface only, and that more eſpecially to which the ſun is vertical, and even here not without taking into the account what probably is not poſſible, an unclouded atmoſphere.

And hence the cometarians, if ſuch inhabitants there are, of which I little doubt, may not ſuffer ſo great inconvenience from the perihelion heat as may at firſt be ſuſpected: for ſoon after the comet is deſcended within the ſphere of the earth's orbit, the ſolar influence upon the waters, or other fluids, would ſoon be ſufficient to raiſe a thick and impenetrable fog into its atmoſphere, ſo as to prevent the inhabitants even of the equatorial parts from periſhing, ſo nicely does the adjuſting hand of Providence regulate the laws of nature, and make them operate to the due preſervation of life.

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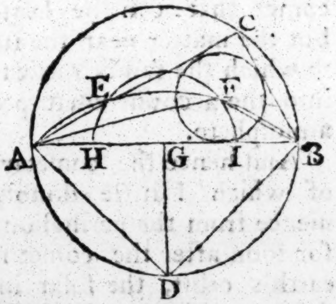
* The quantity A may be eaſily determined from the given perihelion diſtance and periodic time, thus: by Newton, in caſe of elliptic orbits, $\text{P} : 1 :: x^{\frac{3}{2}} : 2^{\frac{3}{2}}$ (x being the major axis), theref. $x = 2\text{P}^{\frac{2}{3}} = 50\cdot863$. Put $d = \cdot44851$, the given perihelion diſtance, then by Conics $\sqrt{\overline{x-d}\times d} =$ ſemi-conjugate axis $= 4\cdot7572$; whence $\text{A} = 120\cdot93 \times 3\cdot14159$, &c.

It may not be ſo eaſy, perhaps, to account for the ſubſiſtence of theſe inhabitants, whilſt they are ſluggiſhly carried through the cold regions of the aphelion, unleſs the electric fluid, which is eſteemed, by experimentaliſts, the grand vehicle of animal and vegetable life, and of which comets are obſerved to ſuperabound on the compariſon with planets, which move in more regular orbits, may be ſuppoſed to contribute a principal ſhare towards a ſolution of the difficulty.

Ingenious ſolutions were alſo given to this queſtion by Meſſieurs John Howard, John Jackſon, Wm. Mudge, John Sampſon, Tho. White, and S. Woolcott.

A Correction of Mr Burrow's Solution of Queſt III (865), in the Diary for 1788, by himſelf.

"My anſwer to queſtion III. (865), though ſtrictly true when the legs of the triangle are equal, and may ſerve when nearly ſo, yet when their difference is great, the anſwer will be erroneous; and as I look on the queſtion to be a uſeful one, I have ſent a general conſtruction, equally as eaſy and ſimple as the other, the inſertion of which will very much oblige your humble ſervant, JOHN BURROW.



With the given half hypothenuſe as a radius, deſcribe the circumſcribing circle ACBD whoſe diameter is AB; alſo with the ſame centre, and radius equal to the given diſtance of the centres, deſcibe the locus HEFI, in which the centre of the inſcribed circle will be found; laſtly, with the centre D in the middle of the ſemi-circle ADB, and radius DA or DB, deſcribe the ſegment AEFB; then ſhall the centre of the inſcribed circle be in the interſection E or F; and therefore with the centre F deſcribe that circle to touch AB; and laſtly, draw AC, BC to touch the ſaid circle, and they will meet in C in the circumference of the firſt circle, and complete the required triangle ABC.

For the ∠ADB being a right angle, and an angle at the circumference but half an angle at the centre, therefore the ſegment AFB is half a quadrant, or the ∠AFB the ſupplement of half a right angle, and conſeq. the ſum of the angles FAB

$+FBA =$ half a right angle. But becauſe of the inſcribed circle, the $\angle FAC = FAB$, and $FBC = FBA$; theref. $\angle CAB + CBA$ $=$ a right angle, and conſeq. the $\angle C$ is a right angle, and theref. the point C is in the circumference of the ſemi-circle ACB, &c.

NEW MATHEMATICAL QUESTIONS, *to be anſwered next year.*

I. Queſtion 7, *by Maſter Billy Pitt.*

If a penny be put out at 5 per cent. compound intereſt, in what time will it amount to a ſum ſufficient to diſcharge the national debt, which is reckoned to be 240 millions of pounds ſterling.

II. Queſtion 8, *by Mr John Birch, of Moulton.*

A father left to his three daughters, Betſey, Beatrice, and Barbara, a piece of land, in form of a rectangle, containing 20 ac. 2 ro. 8 p. to be divided amongſt them, ſo that the firſt ſhould have $\frac{1}{3}$, the ſecond $\frac{1}{4}$, and the third $\frac{1}{5}$, or that their ſhares ſhould be in proportion as the numbers $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$; the diviſion to be made by lines parallel to the ſhorter ſide, which is 12 chains. Required what is each daughter's ſhare, and the diſtance for the ſame to be ſet off upon the length of the parallelogram?

III. Queſtion 9, *by Mr Eliſha Dunton, of Uxbridge.*

Two gentlemen having each an eſtate of equal magnitude, the one in the form of a circle, and the other in a ſquare form; on repairing the fences, they find that the one paid for 40 poles more of hedging and ditching than the other; then what is the content of each incloſure?

IV. Queſtion 10, *by Mr Ra. Burton, Land Surveyor at Salton, near Kirby-moorſide, Yorkſhire.*

How many acres are contained in the ſpherical triangle, on the ſurface of the earth, the three angular points being London, Peterſburg, and Conſtantinople, whoſe latitude and longitude are as below:

	lat.	long.
London	51° 31′	0° 05′ W.
Peterſburg	59 56	30 14 E.
Conſtantinople	41 00	28 48 E.

V. Queſtion 11, *by Mr Alex. Rowe, of Reginnis.*

Suppoſe the capacity of a pair of bellows, when expanded, to be ſuch as to contain 2 ale gallons of air, the diameter of the ſpout or nozzle $\frac{3}{8}$ of an inch, and that it is compreſſed together with an uniform force in one ſecond of time; it is propoſed to determine the velocity of the iſſuing fluid.

VI. Queſtion 12, *by Mr Tho. Molineux, of Macclesfield.*

The hour and ſecond hands of a watch are exactly together at 12 o'clock; then when are they next together, and how many conjunctions of theſe two hands are there in every 12 hours?

ECLIPSES, &c. *for this year* 1790.

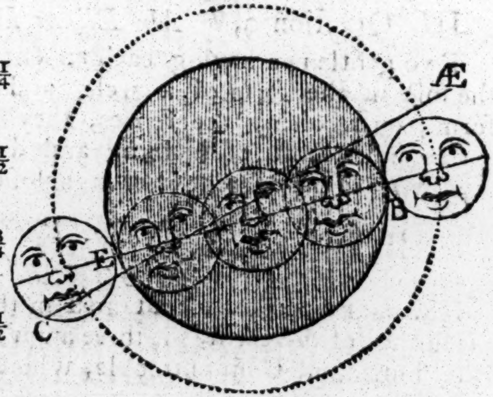
In the courſe of this year there will happen ſix eclipſes, viz. four of the ſun, and two of the moon; the two latter being large total eclipſes, and will be both viſible in theſe parts, if the weather be clear; but the four ſolar eclipſes are none of them viſible in theſe parts. They happen in the following order:

1. The firſt is a ſmall ſolar eclipſe, on Wedneſday the 14th of April, at 29 min. after our 12 at noon; but at that time the moon having great north latitude (viz. 1° 24′), the eclipſe will not be viſible in theſe kingdoms.

2. The ſecond is a large total and viſible eclipſe of the moon, on Wedneſday the 28th of April; the circumſtances and type of which are as follows:

Times, &c.	h.	m.
Beg. of eclipſe	10	10 $\frac{1}{4}$
Beg. of tot. dark.	11	8
Mid. of eclipſe	11	56 $\frac{1}{2}$
End of tot. dark.	12	45
End of eclipſe	13	42 $\frac{3}{4}$
Dur. of tot. dark.	1	37
Dur. of the eclip.	3	32 $\frac{1}{2}$
Digits eclipſed	20°	1′

Type at the Middle.



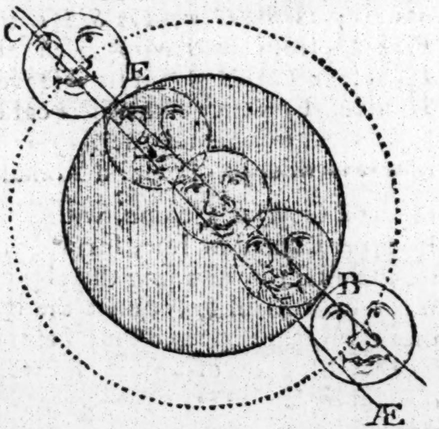
That is, at London the eclipſe begins, or the eaſt ſide of the moon touches the earth's conical ſhadow at B, at 10 min. after 10 o'clock at night, &c. and the times and appearance will be nearly the ſame all over the iſland.—*Note,* the type is drawn for the poſition at the middle of the eclipſe, where ÆC is a portion of the ecliptic, and BE the path of the moon through the earth's ſhadow, B denoting the beginning, and E the end of the eclipſe.—At the time of the middle of this eclipſe, the moon will be vertical to a place nearly 400 miles eaſt from the iſland of St. Helena, in the Pacific ocean; and therefore the eclipſe will be viſible in all Africa, Madagaſcar, the Indian Sea, the weſtern parts of Aſia, all Europe, the Atlantic Ocean, moſt part of South America; and the moon will riſe totally eclipſed to the Weſt Indies, and all along the weſtern coaſt of North America, Greenland, &c.

3. The 3d is a ſmall ſolar eclipſe, on Friday the 14th of May, at 36 min. after 4 in the morning. But on account of the moon's great ſouth latitude (which is 1° 13′½), although the ſun is at that time above our horizon, the eclipſe will not be viſible to Europe or Aſia.

4. The 4th is another ſmall inviſible eclipſe of the ſun, on Friday the 8th of October, at 36 min. after 8 in the morning. But, for the ſame reaſon as before, the eclipſe will not be viſible in theſe northern parts of the globe, the moon's lat. being 1° 27′ ſouth.

5. The 5th is another large total and viſible eclipſe of the moon, on the 22d and 23d of October, as follows:

Type for the Middle.



Times, &c.	h.	m.
Begin. of the eclipſe	10	56
Begin. of total dark.	12	3
Mid. of the eclipſe	12	54
End of total dark.	13	46
End of the eclipſe	14	52½
Dura. of total dark.	1	43
Dura. of the eclipſe	3	56½
Digits as eclipſed	18°	55′

In the annexed type ÆC is the poſition of the ecliptic at the middle of the eclipſe; and BE the path of the moon through the earth's ſhadow.—At the middle of this eclipſe, the moon will be vertical near the river Gambia in Africa, and therefore the eclipſe will be viſible to all the ſtates and kingdoms in Europe, Africa, the weſtern parts of Aſia, and almoſt all America.

6. The 6th and laſt, is a ſmall ſolar eclipſe, which happens on Saturday the 6th of November, at 21 min. after 6 o'clock in the evening, and being after ſun-ſet, is conſequently inviſible to us.

It was intended to inſert here a liſt of all the ſolar eclipſes that will be viſible till the year 2000, as they were computed and ſent by Mr. Wm. Chapman, adapted to the town of Foxton, in Leiceſterſhire, containing the beginning, middle, end, and duration of the eclipſes, with the digits eclipſed; but they muſt be deferred till another year, for want of room here.

THE COMET.

The Comet which was predicted laſt year, has not yet appeared, or been heard of, in theſe parts at the writing of this: however, aſtronomers do not deſpair of it, till the end of this year ſhall be elapſed. Whether it be, that the two comets obſerved by Apian and Hevelius were not the ſame, but different ones, notwithſtanding the near approach of their elements to each other; or whether the diſturbing forces of the more diſtant planets, Jupiter, Saturn, the New Planet, and probably many more planets not yet diſcovered, cauſe ſuch irregularities in the returns of ſome comets, as to render our predictions and calculations of them very uncertain, it may be difficult to ſay, with preciſion; but from ſuch cauſes as theſe it is certain that Cometology is yet in a very imperfect ſtate.

Of the NEW PLANET.

The planet lately diſcovered has already received various names; as the *Georgium Sidus*, the *Georgian Planet*, the *New Planet*, (from its having been newly or lately diſcovered), *Herſchel's Planet* (from its diſcoverer Herſchel), and the *Planet Herſchel*, by which name it is called by the aſtronomers of all foreign nations; and the ſign or character by which they denote it is this, ♅, viz. a Roman **H** as being the initial letter of the diſcoverer's name, with the horizontal bar of it croſſed by a perpendicular line, forming a kind of croſs, the emblem of Chriſtianity, meaning thereby perhaps that its diſcovery was made by a chriſtian, or ſince the birth of Chriſt, as all the other planets were diſcovered long before that period.

The diſcovery of this planet was made at Bath, in the night of March 13, 1781, by Mr. (now Dr.) Herſchel, a German, who there followed his profeſſion of a Muſician, but occaſionally amuſed himſelf with framing teleſcopes, and making aſtronomical obſervations. And he has ſince alſo diſcovered two ſatellites or moons to the ſame planet, and one to the planet Saturn.

The place of the planet for the year 1790, as viewed from the earth, is as follows, viz. longitude from 6° to 14° of the ſign Leo, and the latitude from 38′ to 41′ North; from which it may be found by a teleſcope, for it is not viſible to the naked eye.

But the diſtances, magnitudes, periods, revolutions, calculations, and its ſatellites, muſt be deferred till another opportunity.

N. B. *The propoſition ſent by* Dynamicus *came too late to hand, to be inſerted this year, but is intended for next year.*

F I N I S.

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FINIS.